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**SPECIAL ADVANCED STUDIES FOR
POLLUTION PREVENTION**

**Delivery Order 0058: "The Monitor" –
Summer 1999**



**Science Applications International Corporation
11251 Roger Bacon Drive
Reston, VA 20190**

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STINFO FINAL REPORT

**MATERIALS AND MANUFACTURING DIRECTORATE
AIR FORCE RESEARCH LABORATORY
AIR FORCE MATERIEL COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, OH 45433-7750**

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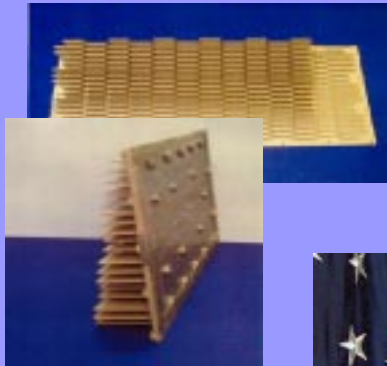
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(ESH) WITH THE ENGINEERING DIRECTORATE ... SEE INTERVIEW
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THE MONITOR ON INTERNET



This issue of the MONITOR is available on the Internet at the ASC site (<http://www.asc.mil/monitor.htm>). The current issue of the MONITOR is in a Portable Document Format (PDF) file which requires a reader program for viewing or downloading. The Adobe Acrobat reader is available for downloading at no cost.

Feature Story

AERONAUTICAL SYSTEMS CENTER (ASC) PLACES THE RESPONSIBILITY FOR ACQUISITION ENVIRONMENT, SAFETY, AND HEALTH (ESH) WITH THE ENGINEERING DIRECTORATE

The acting Secretary of the Air Force, Mr. F. Whitten Peters has committed the Air Force “to protecting the American people and natural resources through strong environmental programs and sound operating practices, while at the same time ensuring we accomplish the Air Force mission. At the same time DoDD 5000.1 charges every Program Manager with preventing, mitigating, or remediating environmental damage caused by acquisition programs. Prudent investments in pollution prevention can reduce life-cycle environmental costs and liability while improving environmental quality and weapon system performance.

- General Raggio

On 31 March 1999, General Raggio, the Commander of Aeronautical Systems Center (ASC), officially placed the responsibility of integrating Acquisition Environment, Safety, and Health (ESH) under the Engineering Directorate (see Figure 1 for the new organizational chart). This initiative streamlines Acquisition ESH efforts within the System Program Office (SPO) with DoD 5000.2-R requirements. Section 4.3.7 of DoD 5000.2-R mandates that every program, regardless of Acquisition Category (ACAT), integrate ESH issues into the Systems Engineering Process.

“I believe there’s no better time in the weapon system acquisition process to address Environment, Safety and Health concerns than early in the engineering and design process. This is why I made the decision last year to integrate the Acquisition Environmental Management function into the Engineering Directorate. I can think of no better person to institutionalize pollution prevention into the weapon system acquisition process than the Chief Engineer and his staff.”

- General Raggio

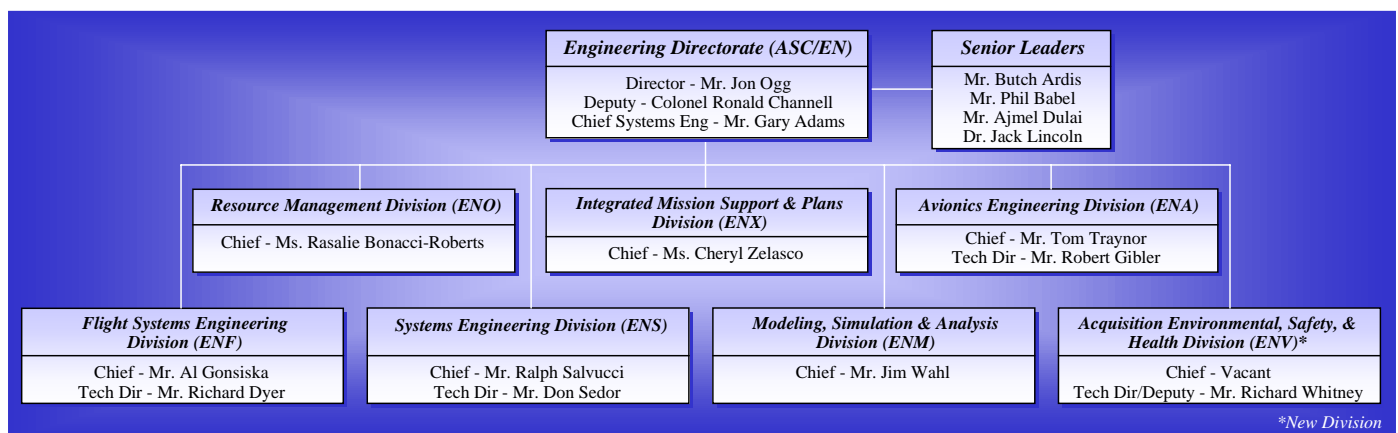
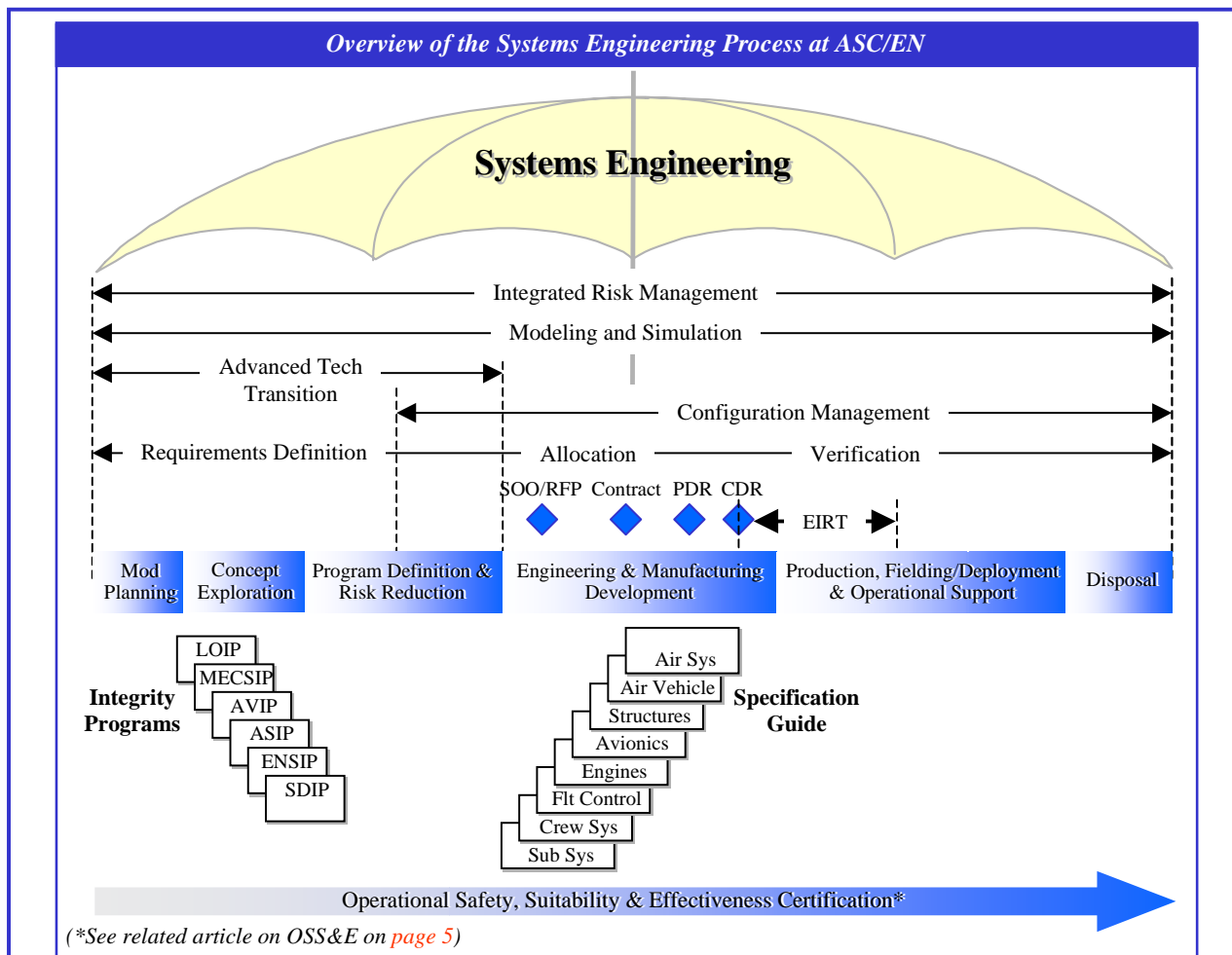


Figure 1. Acquisition Environmental, Safety & Health (ENV) Division Reports to ASC/EN

ASC/EN’s mission is to provide engineering and technical support to military aerospace systems through the weapon system life cycle. The products, services, and processes provided by ASC/EN are used by their customers to support primarily warfighters, maintainers, and trainers. The Systems Engineering Process is supported at ASC/EN through 21 different functional areas. The Acquisition Environmental, Safety, & Health Division (ASC/ENV) supports two of these 21 functional areas, as shown in Figure 2 on page 3, and further discussed in a related article on [page 8](#).

The feature story for this issue of the MONITOR summarizes the integration of Acquisition ESH into the systems engineering process at ASC. Articles include an overview of the draft policy regarding Operational Safety, Suitability & Effectiveness (OSS&E), an interview with Mr. Jon Ogg, the Engineering Director, an overview of the Acquisition Environmental, Safety and Health (ASC/ENV) Division, a summary of the Acquisition ESH Process at ASC, and feedback on the challenges of integrating ESH into the systems engineering process. ♦



Summary of ASC/EN's 21 Functional Areas that Support the Systems Engineering Process**

Avionics Engineering Division (ASC/ENA)	Flight Systems Engineering Division (ASC/ENF)
<ul style="list-style-type: none"> Avionics Systems/Integration Engrg Comm/Nav/Identification Engrg Defense Systems/Recon Engrg Embedded Computer Sys Engrg Low Observables Engrg Offensive Sys/Sensors Engrg 	<ul style="list-style-type: none"> Flight Systems Integration Engrg Aeromechanics/Flight Control/Flying Qualifications Air Vehicle Subsystems Engrg Crew/Human Systems Engrg Propulsion Engrg Structures Engrg
Systems Engineering Division (ASC/ENS)	Acquisition Environmental Management Division (ASC/ENV)
<ul style="list-style-type: none"> Systems Engineering Stores Integration Engrg Support & Training Systems Engrg Configuration & Data Management Manufacturing & Quality Management 	<ul style="list-style-type: none"> Acquisition Environmental, Safety & Health Engrg Industrial Plant Management/Environmental Stewardship
	Modeling, Simulation and Analysis Division (ASC/ENM)
	<ul style="list-style-type: none"> Modeling & Simulation Engrg Survivability/Vulnerability/Effectiveness Engrg

(**See related article on ASC/ENV on pages 8-9)

ASC/EN's Focus Areas

- | | |
|--|--|
| <ul style="list-style-type: none"> Life Cycle Technical Support of Major New and Upgraded Weapon Systems Operational Safety, Suitability & Effectiveness (OSS&E) Aging Aircraft Modeling, Simulation, and Analysis Advanced Technology Transfer Council (ATTC) Lean Aerospace Initiative | <ul style="list-style-type: none"> Joint Aeronautical Commanders Group (JACG) AF Industrial Plants Accident/Incident Investigations Major Independent Reviews Air Transportability Test Loading Agency (ATTLA) DoD Aeronautical Standardization Office Low Observables (LO) Focus Group |
|--|--|

Figure 2. Linking the Systems Engineering Process to ASC/EN's Divisional Responsibilities

AFMC REORGANIZES ITS SYSTEM PROGRAM OFFICES (SPOs)

Recently, Air Force Materiel Command (AFMC) re-organized its System Program Offices (SPOs) to better serve its product lines of aeronautical, space, command/control and intelligence, and air armament. With the re-organization, Aeronautical Systems Center (ASC) gained responsibility for integrating and maintaining humans in Air Force systems and operations, and Eglin AFB gained Program authority for Armament Programs.

Under the new organization, Human Systems Center (HSC) has been re-designated as the 311th Human System Center Wing, and reports directly to ASC. The name re-designation will not change the mission of Human Systems Wing, which serves as the Air Force advocate for integrating and maintaining humans in Air Force systems and operations.

Armament Programs, which are manned at the Air Development and Test Center (ADTC) but were historically managed by ASC, were re-assigned to Eglin AFB. The new product center, designated as the Air Armament Center (AAC), is responsible for managing development, test, procurement, and support of air-delivered weapons, and the full range of life-cycle responsibilities for armaments. ♦

OPERATIONAL SAFETY, SUITABILITY, AND EFFECTIVENESS (OSS&E) ASSURANCE PLACES CRITICAL RESPONSIBILITY ON CHIEF ENGINEERS

The Commander of Air Force Materiel Command (AFMC), General Babbitt, has long been concerned about configuration control of Air Force Systems. Seeing mishaps occurring due to changes being made to systems in the field without application of disciplined engineering processes and unclear accountability/ responsibilities, he became concerned about the process that the Air Force uses to assure Operational Safety, Suitability & Effectiveness (OSS&E).

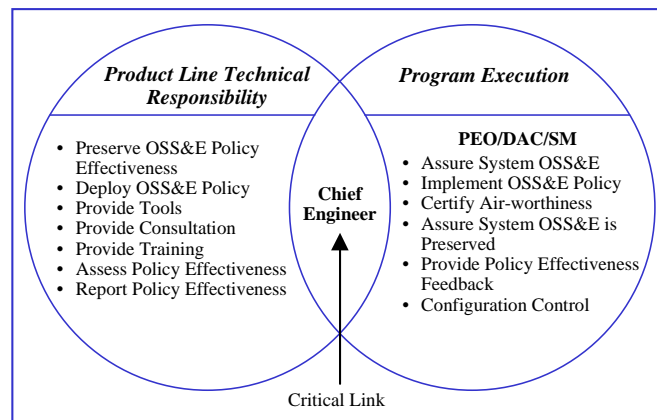
In December 1997, after receiving a briefing from Aeronautical Systems Center's Engineering Directorate (ASC/EN) on Airworthiness Certification, General Babbitt was convinced that his concerns were both well founded and demanded immediate attention. He directed the preparation of an Air Force Policy Directive and Air Force Instruction for the assurance of OSS&E of Air Force systems and end-items throughout their life. Both the Air Force Policy Directive 63-12 and Air Force Instruction 63-1201 have been prepared and are presently at Air Staff for final coordination and issuance. The primary purpose of this policy is to:

- Ensure systems and end-items are delivered that enable the continuing assurance of operational safety, suitability, and effectiveness.
- Require preservation of operational safety, suitability, and effectiveness baseline characteristics of systems and end-items over their operational life.

Draft Air Force Instruction (AFI) 63-1201 defines the process for establishing and preserving OSS&E for Air Force systems and end items over the entire operational life. AFMC Instruction 63-1201 has also been drafted which assigns responsibilities to AFMC Centers and requires the development of process, technical standards, and practices by product lines. (i.e., aeronautical, space, command/control and intelligence, and air armament.)

The new policy requires that a Chief Engineer or Lead Engineer be assigned to each program managed within AFMC. Basket Program offices may share a chief engineer, based on workload. Although authority can be delegated by the Chief Lead Engineer, responsibility and accountability remains with the Chief Engineer. In summary, the Chief Engineer/Lead Engineer is responsible and accountable for OSS&E for his/her system throughout the life cycle including:

- Development of systems and end-items to assure baseline compatibility.
- Managing system configuration including all supply items and user initiated changes.
- Development of inspections and maintenance actions to prevent operational degradation.
- Development and update of the technical content of operational and maintenance manuals.
- Assurance that manufacturing and repair entities deliver quality products.



For further information regarding OSS&E, please contact Mr.

Charles Garland at DSN 785-9701 or Col Lee Monroe at DSN 787-4311. ♦

AERONAUTICAL SYSTEMS CENTER'S ENGINEERING DIRECTORATE SPEAKS WITH THE MONITOR



Mr. Jon S. Ogg, the former chief engineer for the F-22 Systems Program Office (SPO), assumed leadership for the Aeronautical Systems Center's Engineering Directorate on April 12, 1999. As the chief of the 1,400 person Engineering Directorate, Mr. Ogg will provide overall management guidance for planning, organizing, and controlling the development of the systems engineering program at ASC. The MONITOR met with Mr. Ogg to discuss his new position and the recent integration of Acquisition Environment, Safety and Health (ESH) under his directorate.

Q. What is your vision for the future of the Engineering (EN) Directorate and the role of Acquisition Environment, Safety and Health (ESH) in this overall vision?

A. It is my vision that EN will be the pedestal upon which ASC will be held up as the DoD center of Acquisition Innovation and Excellence into and beyond the turn of the Century. To achieve this vision we need to look at what we do, why we do it, how we do it, and opportunities for improvement that will better position us and the Air Force for the ever-changing future.

I want ASC to be #1 in acquisition, pioneering new and innovative ways for managing the development and fielding of systems/products for our extensive customer base. ASC will only be # 1 if we are #1 in what we do in support of ASC's mission. We must be customer focused, forward looking, agile and constantly identifying and pursuing improvements in everything we do. We need to have breadth, as well as depth in what we do, training through experience and continuing education in order to be the next leaders of programs and people.

I suggest that we will be smaller, have a larger non-organic component, and will constantly be challenged to do things faster, cheaper, & better than before. We need to be more integrated with the other functionals, particularly SY, and will need to be viewed as providing a complementary role with AFRL in guiding and fielding new technologies. Most important of all we must have fun and enjoy what we do, otherwise it will not be enduring.

As for Acquisition ESH, the engineering community acknowledges their role and responsibility for this function. With the recent re-organization at ASC, this piece of the process is no longer an adjunct function, but an integral part of our systems engineering process. In this fast paced environment, if you are not a part of the team at the outset, it becomes difficult to influence the decisions that are being made which will determine the course of history particularly with respect to total ownership cost. The recent integration of the Human Systems Wing (HSW), located at Brooks AFB into ASC has served to increase the visibility and awareness of the seven human system factors; manpower, personnel, safety, human factors, health and survivability in the acquisition process. Both of these recent changes, ESH becoming part of the EN Directorate and HSW's accession, are extremely positive moves that will enhance the Systems Engineering process by insuring a voice at the table for ESH.

“...ESH becoming part of the EN Directorate and HSW's accession are extremely positive moves that will enhance the Systems Engineering process by insuring a voice at the table for ESH.”

Q. Currently, there is a draft Air Force Instruction that addresses Operational, Safety, Suitability and Effectiveness (OSS&E) assurances and focuses on systems configuration and risk management. How do you see the OSS&E requirements and Acquisition ESH requirements (i.e., systems safety, HAZMAT Program) supporting each other?

A. OSS&E constitutes an overarching policy/guidance that impacts the Systems Engineering process, and hence includes Acquisition ESH. Obviously, safety is explicitly addressed and is the principal reason why this new policy is being advocated. Acquisition

“...Deputy Program Manager and the Chief Engineer must take leadership roles in the Environmental and Safety Working Groups. This sends a clear message that ESH is important in the decisions being made during development.”

sition Environmental and Health (EH) issues would be addressed under suitability, or the third leg of the OSS&E stool. Acquisition EH issues are critical to the fielding of a weapon system. As is well known, the decisions made in the development phase impact the life cycle cost. This is particularly true when considering the consequences of ESH decisions. For this reason, the Deputy Program Manager and the Chief Engineer must take leadership roles in the Environmental and Safety Working Groups. This sends a clear message that ESH is important in the decisions being made during development.

Q. Recently, the ASC commander decided to organizationally place the responsibility for Acquisition ESH under EN. What is your opinion about this new structure?

A. The new structure is totally in keeping with my recommendation to the Process Action Team (PAT) tasked with assessing the merits and drawbacks of this merger. As the F-22 Chief Engineer, that was exactly how I had organized the F-22 SPO - ESH was assigned to the Engineering organization and directly reported to me. This was the logical arrangement since Engineering is charged with prosecuting the design both through requirement definition and development oversight. As I said earlier, having the Acquisition Environment, Safety and Health Division under Engineering brings them that much closer to being an integral part of the design/development team rather than serving an adjunct function. In keeping with this philosophy, I have selected Col. Ron Channell, former ESH Division Chief to serve as my Deputy within the Engineering Directorate. I believe this sends a clear message about the importance of this issue.

“...having the Acquisition Environment, Safety and Health Division under Engineering brings them that much closer to being an integral part of the design/development team rather than serving an adjunct function. In keeping with this philosophy, I have selected Col. Ron Channell, former ESH Division Chief to serve as my Deputy within the Engineering Directorate.”

Q. Do you feel that evaluation of ESH considerations should be mandatory at all Program Reviews?

A. I don't know that I would go so far as to suggest highlighting ESH as a mandatory review in Program Reviews. Many times, we have Program Reviews to cover a specific issue and as such, it may not be appropriate to single ESH out. However, it needs to be an integral part of the requirement set and captured in the Integrated Master Plan, contract language, and other such documents. Acquisition ESH needs to be in place as an enabler/stimulus within the Systems Engineering process. Currently, specific forums, such as Environmental Working Groups (EWGs) and System Safety Working Groups (SSWGs) are set up to review the progress/execution. I have been impressed with the ability of these groups to bring together the appropriate stakeholders to address the issues. As I commented earlier, I recommend that these working groups be chaired by the System Program Director (SPD), Deputy SPD, or the Chief Engineer.

Q. ESH integration, as defined by DoD 5000.2-R, may require acceptance of serious risk by DACs and high hazard by the PEOs. In your current position and in your former role as Chief Engineer at F-22, how have you historically made decisions about mitigating serious risk or high hazard associated with ESH integration into weapon systems?

A. As you well know, the Hazard process is an extremely methodical and structured process. In fact, it has served as a template for the development of other tools, like the Integrated Risk Assessment (IRA) developed jointly between EN and FM. The Safety team has done a marvelous job of identifying and categorizing the hazards using Failure Modes and Effects Analyses (FMEAs) as well as other data. In addition, they have been instrumental in helping to identify what might be done to mitigate/reduce the severity or probability of an event. The very process is solid in highlighting and requiring senior program leadership to approve serious and high hazard risks. The very fact that they must sign off ensures that this isn't taken lightly. A risk is reviewed/scrubbed numerous times before I, as Chief Engineer, recommend endorsement. For the F-22, we only had one serious risk, G-Loc. Suffice it to say it received, justifiably so, a great deal of visibility not only with the acquisition community, but also with the customers, Air Combat and Air Education and Training Commands, before a decision was made to accept it.

- Q. AFI 32-7086, Hazardous Materials Management, prohibits the Single Manager (SM) from increasing ESH risks when choosing alternatives for Ozone Depleting Substances (ODSs) and EPA-17 materials. How would you like to see ESH Risk Management handled at ASC?
- A. Currently, the Program Offices are handling the mitigation of ESH risk and the Front Office Group (FOG) is involved by serving in the role of Chairman for the Environment and System Safety Working Groups. We are all tuned into the statutory requirement to eliminate ODSs. However, the mitigation of ESH risks associated with the use of EPA-17 and other identified hazardous materials will require a concerted effort across all programs. To this end, the home office is responsible for providing the policy, tools, training, and advice/support to these programs. Mitigating ESH risks is just another consideration that the SPD, in concert with his customers, needs to deal with in executing a program.
- Q. With the Air Force's new emphasis on Total Ownership Cost (TOC), in your opinion, what is the importance of the ESH mission in reducing TOC?
- A. I believe Reduced Total Ownership Cost (RTOC) has served to highlight the importance and consequences of making decisions focused solely on immediate execution or production and causes one to look at the decision in light of the Life Cycle Cost (LCC) implications. I'm not sure of the impact, given that Safety is looked at across the life cycle. I believe that the environmental and possibly the health piece may become a factor when looking at TOC and the decisions made in development that either favorably or negatively affect TOC. The push to eliminate ODC is driven or supported by statute. Active pursuit to reduce the EPA-17 or other identified hazardous materials, is again a positive move that will benefit the system from a TOC perspective. I believe the momentum is building in making Acquisition EH a critical factor in the design decision process. TOC for Acquisition EH needs to include disposal especially since it can constitute a first order term in the life cycle cost equation. I clearly have it on my scope! ♦

"I believe the momentum is building in making Acquisition EH a critical factor in the design decision process. TOC for Acquisition EH needs to include disposal especially since it can constitute a first order term in the life cycle cost equation. I clearly have it on my scope!"

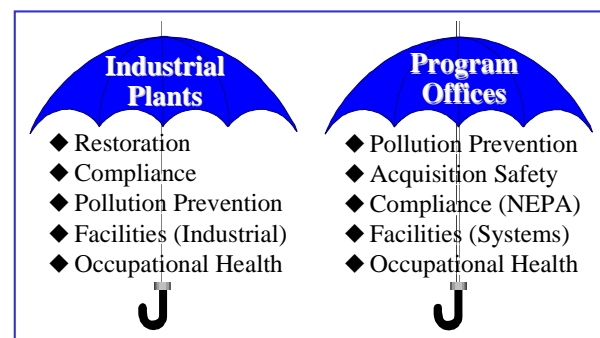
OVERVIEW OF AERONAUTICAL SYSTEMS CENTER, ACQUISITION ENVIRONMENTAL, SAFETY, AND HEALTH (ASC/ENV) DIVISION

The Aeronautical Systems Center, Acquisition Environmental, Safety, and Health Division (ASC/ENV) is responsible for executing two of 21 functional areas that support ASC/EN's System Engineering process. These two functions, as described in Figure 2 (see page 4), include the following:

- Acquisition Environmental, Safety & Health Engineering
- Industrial Plant Management & Environmental Stewardship.

This article summarizes ASC's mission and describes how ASC/ENV is organized to support these two functional areas of the systems engineering process.

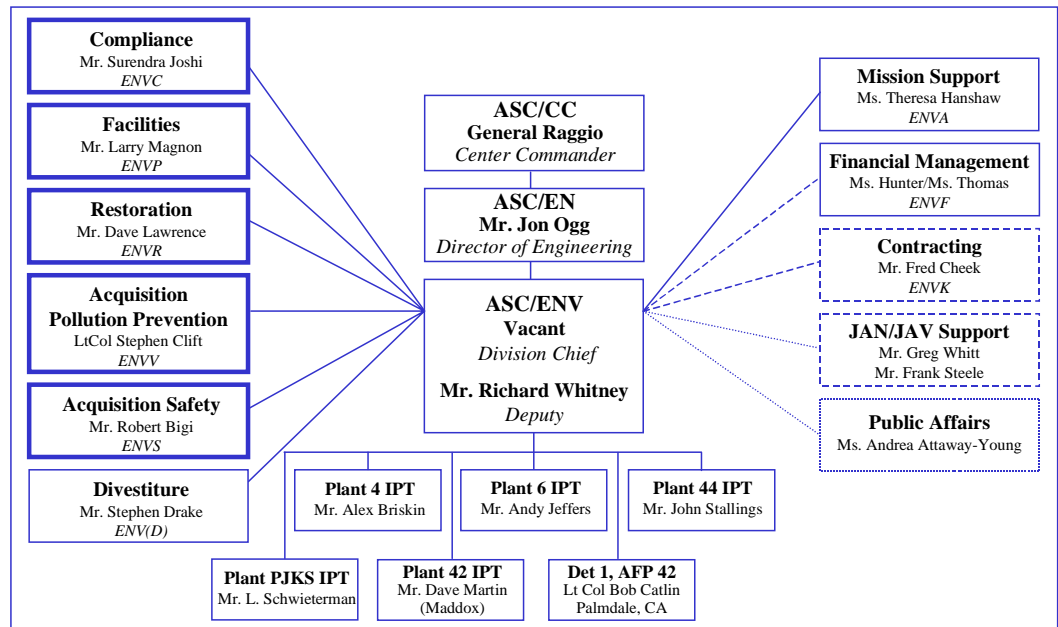
ASC/ENV's mission is to support Acquisition Managers with tools and engineering expertise to successfully manage life-cycle program risk and cost in the Environment, Safety, and Health (ESH) and systems facility arena. ASC/ENV also serves as the Secretary of the Air Force's executive agent for all of the Air Force's Government Owned Contractor Operated (GOCO) Industrial Plants. At the heart of ASC/ENV's mission is a dual focus that supports both the Air Force's Industrial Plants and ASC's System Program Offices (SPOs). In alignment with this dual focus, ASC/ENV is organized into five branches that provide SPO support, system facility support, and stewardship to the Industrial Plants. Details related to ASC/ENV's Acquisition Pollution Prevention, Acquisition Safety, Compliance, and Restoration Branches are provided on page 9.



ASC/ENV Dual Focus

Acquisition Pollution Prevention Branch (ASC/ENVV): The Acquisition Pollution Prevention Branch (ASC/ENVV) and the Acquisition Safety Branch (ASC/ENVS) provide policy and guidance for institutionalizing ESH into the System Engineering process and the weapon system life cycle (see related article on the Acquisition ESH Process on pages 12-14). ASC/ENVV is also responsible for providing leadership, direction and training to the SPOs for minimizing or eliminating the use of hazardous materials and processes in weapon systems. Additionally, ASC/ENVV provides support to the SPOs to ensure compliance with the Environmental Impact Analysis Process (EIAP). The branch includes a home office and co-locates assigned to ASC's SPOs. Details related to the activities of the Acquisition Pollution Prevention Branch are summarized on pages 10 and 11.

Acquisition Safety Branch (ASC/ENVS): The Acquisition Safety Branch (ASC/ENVS) is responsible for developing an effective risk management program to incorporate system safety, flight, weapon system, and ground safety for each Acquisition Program conducted at ASC. The branch uses an integrated approach (i.e., Integrated Product Teams (IPTs), System Safety Working Groups) to implement safety requirements. Additionally, ASC/ENVS has established an effective feedback/hazard tracking system to assure the optimum safety of new acquisition program and system modification. The branch includes a home office and co-locates assigned to ASC's SPOs (see related article on page 11).



Organizational Chart

Compliance Branch (ASC/ENVC): The Compliance Branch (ASC/ENVC) ensures that operators at each of the GOCO industrial plants comply with state and federal environmental laws, rules and regulations. The branch also promotes ongoing environmental stewardship at each of the plants, including pollution prevention initiatives, and ensures that facilities are operated in an environmentally responsible manner. Additional details related to the activities of the Compliance Branch are available on the ASC/ENV web page (<http://www.ascem.wpafb.af.mil>).

Facilities Branch (ASC/ENVF): The Facilities Branch (ASC/ENVF) plans for and evaluates facility needs at the GOCO industrial plants to ensure that proposed facility actions are consistent with sound engineering practice and are acceptable to the Air Force. ASC/ENVF also manages a divestiture program (sale or lease) to comply with DoD's policy to minimize ownership of the industrial plants. ASC/ENVF serves as the primary link between the SPO and the MAJCOM to articulate new weapon system facility requirements to the warfighter. The branch ensures that facility planning and design criteria are developed and properly utilized to support the programming, design, and construction of facilities needed for the beddown of new systems at test, training, operational and depot bases throughout the world. Additional details related to the activities of the Facilities Branch are available on the ASC/ENV web page (<http://www.ascem.wpafb.af.mil>).

Restoration Branch (ASC/ENVR): The Restoration Branch (ASC/ENVR) is responsible for identifying, evaluating, investigating, remediating and monitoring the cleanup of historical contamination at Air Force Industrial Plant facilities. Additional details related to the activities of the Restoration Branch are available on the ASC/ENV web page (<http://www.ascem.wpafb.af.mil>).

For further information regarding the overall activities of ASC/ENV, please contact Mr. Dick Whitney at DSN 785-3054, ext. 447. ♦

GENERAL RAGGIO COMMENTS ON ASC'S ACQUISITION POLLUTION PREVENTION TEAM

Under this new construct, the EN led ASC Acquisition Pollution Prevention Team has provided leadership, direction, and training to ASC weapon system program offices and helped them to minimize or eliminate the use of hazardous materials and processes in weapon systems. As a result, every SPO at ASC has seen reductions in the weapon system Total Ownership Cost through Pollution Prevention initiatives.



Some recent pollution prevention initiatives at ASC include the F-16 Program's switch from chromium to sulfuric acid anodization thus reducing hazardous chromium air emissions to zero, and the F-22 Program's replacement of toxic cadmium on landing gear with tin zinc which will result in a projected 20-year LCC savings of \$3 million. In addition, the Joint Strike Fighter Program will now use electrocoat as a replacement for chromated primer. One coat will last the life of an aircraft and save \$3.5 million per year.

But perhaps the most stunning advancement made has been the Pollution Prevention Team's applied technology program and their Applique' project. The team has demonstrated Applique' film technology as an environmentally friendly topcoat (paint) alternative that reduces hazardous material usage by 90%, reduces maintenance and supportability costs associated with painting and stripping of aircraft by 50%, results in less worker toxic exposure and reduces hazardous disposal costs by 50%. The tremendous return on investment from this \$650,000 project could amount to \$126M in life cycle cost savings per 1000 aircraft.

**- General Raggio, Aeronautical Systems
Center Commander ♦**

OVERVIEW OF THE ACQUISITION POLLUTION PREVENTION BRANCH (ASC/ENVV)

The Acquisition Pollution Prevention Branch (ASC/ENVV) supports the System Program Offices (SPOs) in mitigating the risk and the cost associated with the use of hazardous materials and processes across the acquisition life cycle. This cradle-to-grave insertion of pollution prevention practices into the weapon system life cycle not only improves human health and the environment but can often improve both productivity and quality. Collectively, these two factors, enhancement of human health and the environment, and increased process performance translates into reduced total ownership cost for the weapon system.

Through the home offices and SPO co-locates, ASC/ENVV provides environmental compliance support, training, policy and guidance, and technical support for hazardous material minimization for the F-15, F-16, F-22, Joint Strike Fighter (JSF), B-1, B-2, C-5, C-17, C-135, C-141, special operations aircraft, training systems, and aircraft engine programs.

ASC/ENVV has developed various tools and technologies that impact all the phase of the acquisition life cycle (i.e., weapon system design, manufacturing, test and evaluation, operations, sustainment, and disposal). For example, the Environmental Quality Performance Indicators (EQPI), developed by ASC/ENVV, are used to assess and manage environmental risk during the design phase for all applicable weapon systems within ASC. Currently, ASC/ENVV is continuing its efforts with its Applique project (see [page 11](#) for an update) which offers a potential multi-billion dollar saving potential in weapon system manufacturing. ASC/ENVV is also assisting Program Managers address disposal related concerns related to their weapon system and working closely with Aerospace Maintenance & Regeneration Center (AMARC) to address these concerns (see related article on AMARC on [page 28](#)).

In 1998 ASC/ENVV received several awards for enhancing human health and the environment while reducing the total ownership cost for the Air Force. These awards include the Thomas D. White Award for Pollution Prevention, an Honorable Mention in the Secretary of Defense's 1998 Environmental Security Awards, and an Honorable Mention in the White House Closing the Circle Award (see related article on [page 30](#)). ♦



ASC/ENVV Wins the Thomas D. White Award

UPDATE OF ASC/ENVV INITIATIVES

The Pollution Prevention Handbooks have been consolidated into one handbook that covers all phases of life cycle management. This book replaces the three Pollution Prevention Handbooks that presently reside on the ASC Web Page (<http://www.ascem.wpaafb.af.mil>). The new handbook has been updated, reviewed, and accepted by Air Force Materiel Command's (AFMC's) Center Working Group (CWG), and put into the DoD Acquisition Deskbook.

The Pollution Prevention Road Show Course has been converted to a virtual classroom (VCR) delivery method through the Internet. Course lessons are being beta tested on line now, with the first offering schedule for the end of June 1999. This course will be on line through Systems Acquisition School at Brooks Air Force Base.

The Applied Technology Program has kicked off Phase III of the Applique Project. This is the first project that will apply polyfluorinated film directly onto a primed surface (no topcoat) supersonic aircraft (F16). Among the participants at the kick-off meeting were representatives from F-16, F-15, and B-2 SPOs. Chuck Valley, Program Manager, chaired the meeting, and along with project engineer Mary Wyderski, ensured that various task elements within the scope of the project

were understood by the stakeholders. An ANG F-16 tail number 587 from Duluth, MN is the test bed for this project.

The results of the Weapon Systems Deicing Materials Compatibility Testing, which was completed in September 1998, are available on the SAF/AQRE home page. In cooperation with AFRL, a contract for a second project to continue material compatibility testing has been awarded. This initiative will assist in incorporating military unique test requirements in the commercial deicing materials specifications, and in reviewing/consolidating Air Force unique materials test requirements.

The F-16 Program has initiated an environmental compliance project to fully qualify and implement environmentally compliant substitutes for MIBK, MEK, and Xylene used in FMS-3049 HAVE GLASS specialty coating at both Air Force Plant #4 and OO-ALC. The qualification project will reduce consumption of hazardous chemicals, eliminate burden of record keeping for Toxic Release Inventory (TRI) Reporting, and increase environmental compliance supporting the ultimate goal of zero discharge of hazardous waste at Air Force Plant #4.

The C-17 Program will be developing a Pollution Prevention Homepage. All completed risk assessments/projects and information on current projects will be made available on the page to C-17 installation personnel and other Air Force environmental offices/personnel. The goal is to promote sharing of information and lessons learned on the C-17 HAZMAT elimination efforts, and to avoid duplication of effort. Information on access to the site will be available upon completion of the contract effort.

In support of recent field concerns over the identification of Hazardous Materials in the F-16 aircraft, the F-16 Program has created and put to use the F-16 Hazardous Materials Database. The tool has provided timely field product support resolving numerous hazardous materials questions from customers. For example, the tool helped resolve Mountain Home AFB asbestos concerns; radioactive material concerns at Luke AFB, Singapore AFB, and USAF Museum; and has supported mishap investigations concerns on hazardous material releases.

For more information about the activities of ASC/ENVV, please contact Lt Col Stephen Clift at DSN 785-3054, ext. 308. ♦

OVERVIEW OF THE ACQUISITION SAFETY BRANCH (ASC/ENVS)

The Acquisition Safety Branch (ASC/ENVS) Home Office provides centralized safety expertise to assist ASC's Program Offices, the Engineering Directorates and ASC/ENVS co-locates with system safety program requirements, operational issues, and training. Figure 3 summarizes the ASC SPOs supported by the Acquisition Safety Branch. The duties of the co-locates supporting these programs include the following:

- Serve as the OPR for system safety program requirements
- Evaluate hazard analyses and identify risk areas
- Manage hazard tracking and risk resolution process
- Advise Program Director of unacceptable risks
- Serve as the day-to-day point of contact for program safety issues
- Work closely with ENV co-locates to resolve risk issues related to Hazardous Materials & Pollution Prevention efforts.

Acquisition Safety Serves the Following SPOs:

- ▶ F-22 SPO
- ▶ FB SPO (F-15, JSF, ABL)
- ▶ F-16 SPO
- ▶ Simulator SPO
- ▶ Trainer A/C SPO (JPATS)
- ▶ Special Operations SPO (C-130 Variants)
- ▶ B-2 SPO
- ▶ Subsystems SPO (Engines, Support Equipment)
- ▶ Reconnaissance SPO (U-2, UAVs)
- ▶ C-17
- ▶ Global Reach SPO (Cargo and Commercial Aircraft)

Figure 3. SPO Supported by ASC/ENVS

For additional information regarding ASC/ENVS, please contact Mr. Bob Bigi at DSN 785-3054, ext. 337. ♦

OVERVIEW OF THE ACQUISITION ENVIRONMENT, SAFETY, AND HEALTH (ESH) PROCESS AT AERONAUTICAL SYSTEMS CENTER (ASC)

I cannot overemphasize the importance of the intimate connection between the system engineering process and sound pollution prevention initiatives. Our legacy systems as well as our leading-edge technology programs like the F-22 and JSF must simultaneously consider life-cycle design, national defense needs, and environmental stewardship to ensure our Air Force continues defending our nation well into the 21st Century, while protecting our precious natural resources for generations to come - General Raggio.

Figure 4 summarizes the Acquisition Environment, Safety and Health (ESH) process as Aeronautical Systems Center (ASC). This process continues to evolve and reflects the ESH risks within the Systems Engineering process. The ESH Process Overview was developed as Section 2.7 of the ASC/EN's Technical Process. The whole process can be viewed at http://www.en.wpafb.af.mil/ens/tech_process.html.

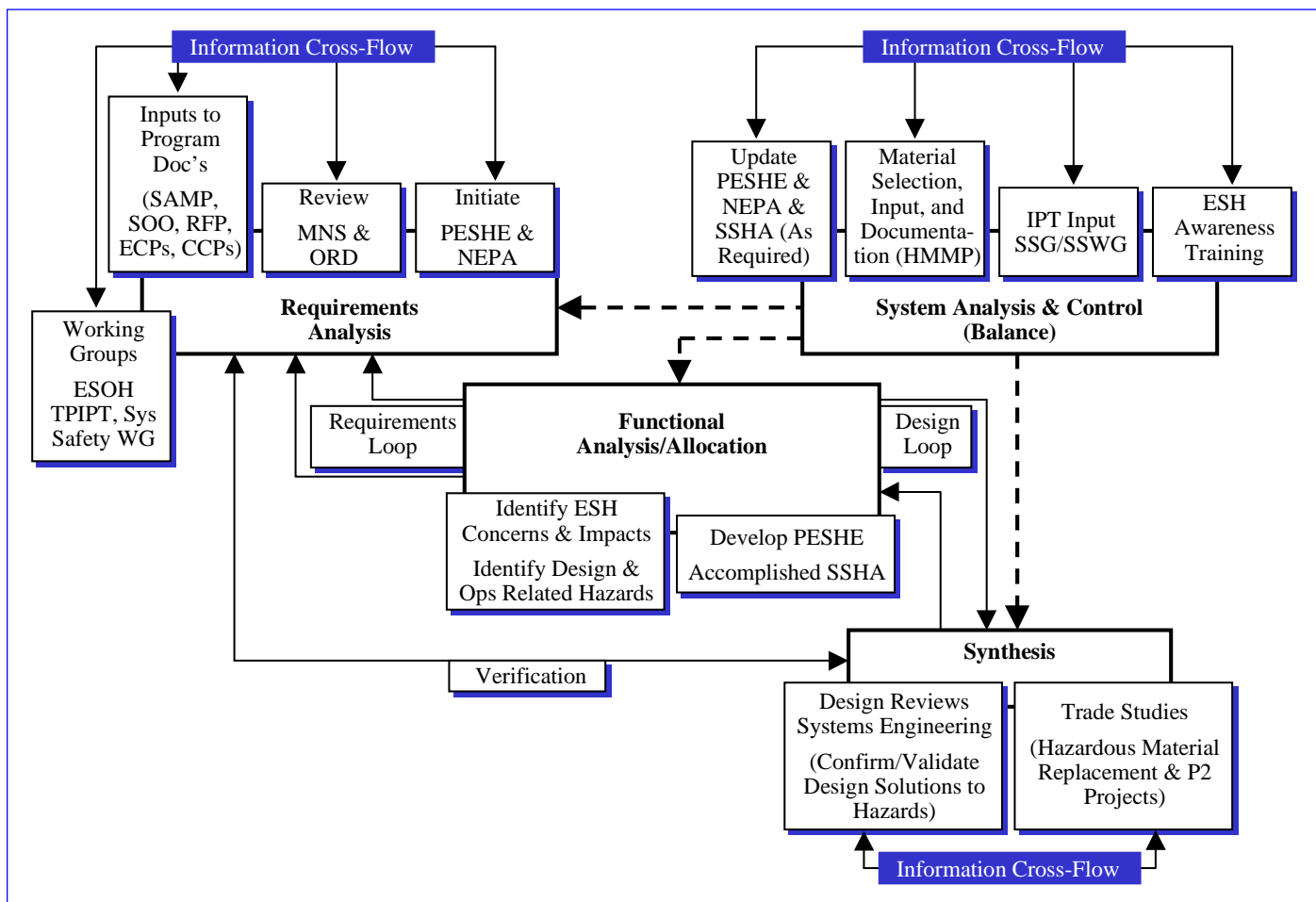


Figure 4. Overview of the Acquisition Environmental, Safety & Health Process at ASC/EN

Details related to the basic requirements to ensure Acquisition ESH requirements are considered during the entire life cycle of a weapon system, from cradle-to-grave, are further discussed below.

Systems Analysis & Control Portion

Under this portion of the process, the overall strategy is developed to address how Acquisition ESH will be considered in the balanced weapon system approach. This strategy must be documented in the Programmatic Environmental Safety and Health Evaluation (PESHE), regardless of system's acquisition category, as required by DoD 5000.2-R. The analysis of other system alternatives and any required mitigation efforts are addressed in the appropriate National Environmental Policy Act (NEPA) documentation. The System Safety Hazard Analysis (SSHA) documents system hazards and identifies the safety impacts of any trade-offs made between performance requirements and the safety of the overall system.

The Hazardous Materials Management Program (HMMP) documents how the contractor and the program office will work to reduce the life-cycle cost impacts of hazardous materials over the entire weapon systems life cycle. ESH personnel help determine the possible life cycle ESH impacts of materials to help ensure a balanced approach during material selection. System Safety personnel utilize System Safety Groups (SSGs) and System Safety Working Groups (SSWGs) to ensure performance requirements are balanced against the overall safety of the system. Safety Hazards above a certain risk level must be approved by the Program Manager, PEO, or possibly SAF/AQ. Top-level ESH Awareness Training is provided to Design and Systems Engineering and other SPO personnel, so they will recognize possible ESH issues that can be brought to the attention of ESH personnel for further study.

Requirements Analysis Portion

Progressive Steps to Incorporate Acquisition ESH During a Weapon System Life Cycle

- 1** A System Program Office (SPO) is required to determine the hazardous materials, (including ODCs) that are in the system or in the process of being implemented into the system and then ensuring they are managed. **(Systems Analysis and Control)**
- 2** Once the hazardous materials have been identified, alternatives should be considered and, where economically feasible, implemented in lieu of the hazardous material. Additionally, environmental life cycle costs and health risk analysis should be considered. **(Synthesis)**
- 3** Following the initial determination of hazardous materials affecting the system, the SPO should ensure both a Program Environmental Safety and Health Evaluation (PESHE) and a Hazardous Materials Management Program (HMMP) are developed for the weapon system. Details related to preparation of these documents are available on the ASC/ENV web site (<http://www.ascem.wpafb.af.mil>) **(System Analysis & Control and Requirements Analysis)**
- 4** A System Safety Program (IAW, a tailored MIL-STD-882 approach) needs to be established for each major program or developmental effort. Such a program provides for identification of design-related and operating hazards in all phases of the system life cycle, and establishes a process in the program office for hazard resolution, tracking and risk reduction efforts. Hazards are resolved and tracked via the IPT process and the System Safety Groups. Residual risk acceptance is the responsibility of the Program Director, PEO, or SAF/AQ and requires coordination with the Center Safety Office and HQ AFMC/SE (Ref para 9.2, AFI 91-202). **(System Analysis & Control and Requirements Analysis)**
- 5** In this step, NEPA documentation is completed as applicable. For further information regarding NEPA, see the ENV web site (<http://www.ascem.wpafb.af.mil/>). **(Requirements Analysis)**
- 6** An EWG and SSG, consisting of Air Force and contractor, is established. This approach follows the risk reduction concepts which are essential in all phases of weapon system life cycle. **(Requirements Analysis)**
- 7** Throughout the environmental life cycle of the weapon system, ESH language should be included in all contractual and acquisition related documentation (MSN, ORD, RFP, etc.). **(Requirements Analysis)**

Under the Requirements Analysis portion of the process, the ESH strategy (or PESHE) is summarized in the Single Acquisition Master Plan to demonstrate to the Decision Authority that adequate ESH requirements are analyzed. The ESH requirements are integrated into the Statement Of Objectives (SOO) and the Request For Proposal (RFP) to ensure the system proposed by the contractor addresses appropriate ESH areas. Changes to the weapon system (via ECPs, CCPs, modifications, deviations, and waivers) are also reviewed to ensure appropriate ESH requirements are addressed. Such changes can also be implemented to reduce ESH life cycle cost. Mission Need Statements and Operational Requirements Documents are also reviewed by the ESH Division to ensure top-level ESH requirements are reflected in these documents.

Environmental Working Groups (EWGs) and SSG/SSWGs, that involve participation from the weapon system contractor and users, delineate user requirements, identify any potential ESH impacts, and solve identified ESH impacts. Additionally, the Environmental, Safety, and Occupational Health Technical Planning IPT (ESOH TPIPT), an Air Force Modernization and Planning process, is used to identify ESH needs/requirements.

The PESHE documents how specific ESH requirements will be addressed in the weapon system. Appropriate NEPA documentation addresses how other system alternatives were examined to see if they meet the minimum requirements.

Functional Analysis Portion

As the lower-level system functions are identified to meet the requirements, ESH personnel can identify possible ESH concerns, impacts, or hazards that may affect the weapon system over its life cycle. SSHAs and PESHE identify the ESH risk associated with these lower level system functions. The SSHAs are design related technical documents, while the PESHE is used to document the overall ESH strategy of the weapon system.

Synthesis Portion

As the specific design is solidified in the synthesis process, the ESH personnel confirm and validate that the proposed design solution will indeed eliminate or reduce the ESH Hazards to an appropriate level.

ESH personnel actively participate in trade studies to identify suitable (qualified) replacements for any hazardous materials under design consideration. ESH personnel also develop and manage Pollution Prevention (P2) projects that identify and qualify non-hazardous material substitutes where no suitable replacements currently exist.

For further information, contact Lt. Col Steve Clift, at DSN 785-3054 ext. 308, or Mr. Bob Bigi, DSN 785-3054 ext. 337. ♦

INPUT FROM ASC/ENVV HOME OFFICE

“What do you see as the challenges to integrating Acquisition Environment, Safety & Health (ESH) into the systems engineering process? How do you recommend addressing these challenges?”



The biggest challenge is education and awareness of the EN workforce. People by their very nature don't like to change and to do things differently, unless there's a good reason for it. It's our challenge in ENVV to educate our colleagues as to the requirements and benefits of a sound P2 program.

Lt Col Stephen Clift
Branch Chief, Pollution Prevention Division (ASC/ENVV)

I think the biggest challenge to integrating ESH into the systems engineering process is developing accurate life cycle costs for hazardous materials. In order to actively participate in the trade studies performed in the systems engineering process, the LIFE CYCLE costs of the materials chosen need to be considered. It is difficult to incorporate non-hazardous substitutes if a cost savings cannot be shown. Most of the other “ilities” (supportability, survivability, maintainability, etc.) can distill impacts in their areas down to dollars, which levels the playing field in these areas and lets you compare the costs and savings across all the “ilities”. ESH is just beginning to enter this arena.



Ted Grady
SPO Support Team Lead, Pollution Prevention Division (ASC/ENVV)



I hate to answer questions out of context. The first thing that comes to mind is to have a clear understanding of the definition of “ systems engineering process”. Also, who, how, and where do you apply it to the acquisition discipline? Furthermore, you want to know who the players are that will influence the final ESH decisions when actually working through the process. In the case of ESH, it is a distributed function and its risk consideration to program cost, schedule and performance must be considered in every task to some degree. It had to be in the mind of the requirements generator, the concept people, the designers, the manufacturers, the sustainment and operational people and finally in the disposal phase. We must get the engineers attention to include ESH in their particular disciplines.

The next major challenge is with the actual teaming required between the environmental, safety and health disciplines in the systems engineering process. We must be more than located in the same area. We must understand each other's roles and how they potentially interact so that we can improve our effectiveness in getting to the best answer with the fewest iterations. I believe we will overcome this challenge, as we have done so many other times, by thinking globally, but acting locally. In the present environment you must stay tuned in, have an open mind, and keep looking for the underlying principles in our evolving guidance. Education is an important part of that. We are on that road with "ESH" awareness training within our SPO's and management has given ESH a seat at the table via the programs DOEs. I am generally optimistic that the proper integration will occur and will be an added value to the "system engineering process."

Furthermore, this means the systems engineering process must be supported with good cost data for proper materials and process selections. We presently do not have insight into ESH LCC to the degree required to support trade-offs between materials selection and alternative processes. We need to profile the ESH LCC cost to support our decisions via the "systems engineering process". This means that the financial community needs a better breakout and tracking system to identify and quantify ESH cost across the weapon systems life-cycle.

Donald Tarazano

Materials Engineer, AFRL/MLSC (co-located to ASC/ENVV)

The Environmental Safety and Health challenges of being integrated into the systems engineering process are:

1. *Keeping the process as simple as possible*
2. *Establishing a common clarity of understanding of the systems engineering process*
 - a. *Determining if the concept at hand, the systems engineering process, is/is not controlled by the Systems Engineering Division*
 - b. *Knowing who the functional players are*
 - c. *Knowing what the functional player's roles and responsibilities are*
 - d. *Knowing how all the functional players fit together*
3. *Establishing criteria to determine if ESH is best integrated via the top-down or bottom-up approach*
4. *Learning to what extent ESH integration into the systems engineering process has already taken place*
5. *Deciding what training is necessary without re-inventing it*
6. *Determining who the most critical to the least critical players are*
7. *Establishing an integration methodology at the earliest open door (not forced open) in the acquisition phase*
8. *Bringing Manufacturing and Quality Assurance (an entity under the Systems Engineering Division) on board for "through-the-shop" materials and processes input*



These challenges can be addressed by doing the following:

1. *Have one office responsible for this entire process along with the authority to implement*
 - a. *Establish a working group to oversee the planning/implementation of the above*
 - b. *Assign a Point of Contact for each of the eight activities above with the responsibility and authority to accomplish the task*
 - *Reward for progress and creativity*
 - *Establish timeline milestones (realistic)*
2. *Assimilate input from 1 through 8 (see above)*
3. *Construct an affective plan for integrating ESH into the systems engineering process*
 - a. *Include measurement parameters to track and status progress, and cost savings*
4. *Implement the plan and expect significant positive results. This is logical and will work*

This is how I see things in this arena and only represents my opinion.

Charles L. Jones

Program Manager, Pollution Prevention Division (ASC/ENVV) ♦

INPUT FROM ASC/ENVV SYSTEM PROGRAM OFFICE CO-LOCATES

“What do you see as the challenges to integrating Acquisition Environment, Safety and Health (ESH) into the systems engineering process? How do you recommend addressing these challenges?”



For the F-16 Program, the biggest challenge is how to interpret and integrate DoD and Air Force environmental policy, procedures, and requirements into a mature weapon system. For example, DoD policy requires a PESHE be developed for each program, regardless of acquisition category, and the PESHE is to be updated at each program milestone. Yet for a mature weapon system, like the F-16, there are hundreds of active programs taking place at any one time, simultaneously in all stages of acquisition. The magnitude of acquisition programs vary from new aircraft production, to aircraft modifications, to parts buys. Further, a broad, overarching weapon system PESHE would lack the detail necessary to describe specific environmental activities and the status of individual programs.

The F-16 Environmental Program Manager, with ESH support contractor SoBran, Inc. is in the process of addressing this issue by establishing a weapon system Environmental Management Plan that will provide instructions, procedures and policies for the integration of ESH into the weapon system. The Environmental Management Plan will not be limited to acquisition elements. The Plan will describe the Environmental Monitoring System, or the automated checks and balances for required environmental reviews, reference how the Hazardous Materials Management Program functions, describe the Pollution Prevention Program, and describe how ESH is integrated into acquisition programs. In short, the plan will serve as an environmental operating instructional manual for the F-16 program.

W. Dennis Scott
F-16 SPO Environmental Program Manager
ASC/YPVE



ESH, in general, is one of many weapon system considerations across the acquisition system life cycle (including Requirements Generation, Design, Manufacturing, Testing, Operation, & Disposal) that must be balanced to meet system performance requirements. It is important to address environmental concerns early in weapons system design, and we must ensure that ESH requirements are consistently applied when considering streamlined acquisition initiatives. Another major challenge is to ensure that key players in the SPO are thinking ESH when making business decisions.

The most important things I recommend for a thriving acquisition ESH program are communication and education. Making ESH training mandatory to all key SPO personnel, including the two-letters, chief engineers, Environmental Working Group members, as well as financial and contracting representatives, is essential.

A hard-hitting Programmatic Environmental Safety and Health Evaluation (PESHE) document that gets your SPO team members involved is crucial, not only to uphold and comply with DoDD 5000.2-R, but also to ensure that ESH is being factored into all phases of acquisition. The Reconnaissance SPO's Programmatic Environmental, Safety, and Health Evaluation (PESHE) outlines the individual strategies and responsibilities that each Program Manager (PM) has undertaken with regard to the individual programs in this “basket” SPO.

Establishing an effective Environmental Working Group (EWG) also helps communicate vital ESH information to the appropriate POCs in your organization. Meet regularly, bring pertinent topics to the table, and keep an open forum for discussion. Keep your objectives clear and include your contractors and customers whenever possible.

Amy L. Mercado
Director, Environmental Management
Reconnaissance Systems Program Office ♦

Policy Update

AIR FORCE INSTRUCTION AFI 32-7080 UPDATE

From FY 92 – FY 98, the Air Force has reduced its Open Enforcement Actions (OEAs) from 263 to 7. However, impending environmental regulations that incrementally become more stringent dictate that the Air Force continues to take a pro-active approach to reduce the cost and the risk associated with environmental compliance.

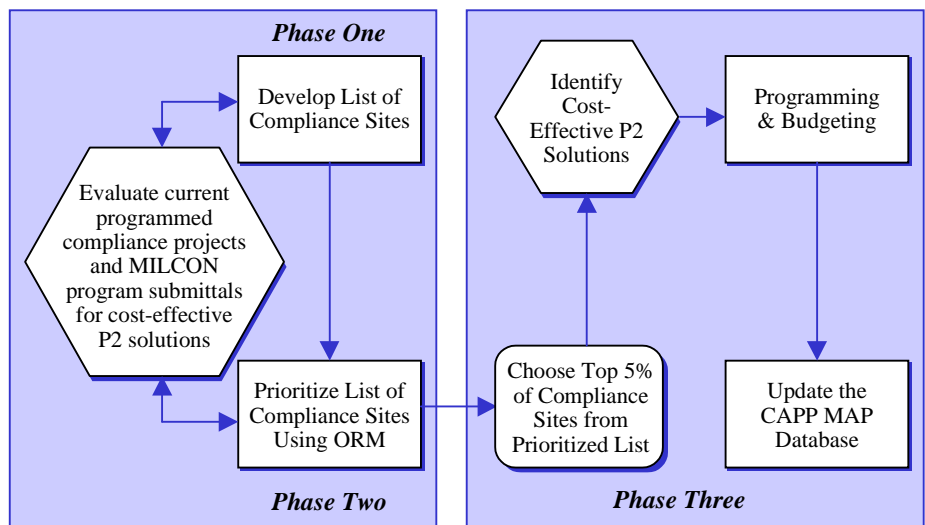
With this objective in mind, the Air Force has drafted a new policy, AFI 32-7080, *Compliance Assurance and Pollution Prevention (CAPP)*, Draft. Central to AFI 32-7080 is the use of pollution prevention (P2) methods and solutions to reduce the cost and risk associated with a compliance site. A compliance site is defined as any regulated facility/process or discharge to a regulated facility/process. Each compliance site represents an economic burden to the Air Force and is a source of potential liability and/or OEA.

The process of using pollution prevention methods and solutions to reduce the burden associated with a compliance site has been defined as Compliance through Pollution Prevention (CTP2). The CTP2 Implementation process, as defined in AFI 32-7080, is further discussed below.

Overview of the CTP2 Implementation Process:

Phase I of the CTP2 process requires that the major commands (MAJCOMs) develop a list of all compliance sites on their bases. Currently, Air Force Materiel Command (AFMC) has identified over 20,000 sites of which a majority are associated with air-compliance related issues.

Phase II involves evaluating and prioritizing the sites in the inventory based on compliance cost and risk level. The latter is based on the probability and severity of a realistic operational scenario. In other words, how likely it would be for an environmental incident to occur at the site and how severe would be the consequence. The categories range from catastrophic to negligible. Finally, in Phase III, installations can target their high burden sites with process specific opportunity assessments. These assessments will identify approaches to reduce cost and risk, and possibly totally remove burden.



Role of the Weapon System Community in the CTP2 Process:

The compliance sites identified within AFMC and other commands can be tied back to a weapon system related activity. Therefore, it becomes important that the weapon system community understands the CTP2 process, and works with the bases and HQ AFMC to program requirements. Future requirements for weapon system P2 projects should identify and address a compliance burden. The largest compliance burden reduction can potentially originate from implementation of a weapon system, source reduction initiative. Additionally, long term reduction in total ownership costs will originate from implementation of such projects.

Currently, AFMC has developed methodology for collecting site specific cost and risk data. The effort is being managed by the 311th HSW/XRE to meet the Phase I milestone of 30 July 99 and the Phase II deadline of 29 October 99.

For further information regarding the CTP2 process at AFMC, please contact Mr. Steve Coyle at DSN 787-7414. ♦

Policy Update

MIL-STD-882 D UPDATE -

Mr. Bob Bigi (ASC/ENVS)

The "D" version of MIL-STD-882 has been in development for three years and has now been honed into a very performance-based document. The final "For Coordination" version of the new MIL-STD-882D will be posted on the HQ AFMC/SES Home Page by early June 1999. Expedient electronic coordination is expected, and the final release is projected for August 1999. Although it is labeled as a Military Standard, it will actually be the Standard Practice for system safety for both industry and government use. It will be the "common industry standard" for system safety. MIL-STD-882D was the result of many months of concentrated efforts by a highly skilled IPT made up of both government and industry system safety experts, who were supported by expert advice from both HQ AFMC/SE and HQ AFMC/EN personnel. This new document is now in the 50-page size range as compared to the "C" version, which is in the 200-page range. This significant size reduction is due to innovative approaches in two main areas:

- a. Re-writing the system safety requirements in performance based language
- b. Re-location of the traditional MIL-STD-882 System Safety "Tasks" from the written document into the DoD Deskbook, the web-based source of acquisition related corporate knowledge.

We will still use this new document to specify hazard identification/tracking and risk reduction efforts in contracts; however, it will now be in a greatly simplified and somewhat standardized manner, due to the performance-based nature of the wording in MIL-STD-882D. Another feature of

MIL-STD-882D is that it will NOT require a waiver for use in RFPs, as does the current 882C. This entire effort is a major contribution by the system safety community to DoD's acquisition reform efforts, as well as a revolution in the approach to system safety taken by DoD. ♦

OCCUPATIONAL SAFETY & HEALTH ADMINISTRATION (OSHA) UPDATE

The big buzzword around Occupational Safety & Health Administration (OSHA) these days is ERGONOMICS. Ergonomics is the science of fitting the job to the worker. Work-related musculoskeletal disorders (WMSDs) result when there is a mismatch between the physical requirements of the job and the physical capacity of the worker. WMSDs account for 34 percent of all lost workday injuries and illnesses. In response to this alarming statistic, OSHA is developing a program that calls for employers to establish ergonomics programs to prevent WMSDs. OSHA's Working Draft of a Proposed Ergonomics Program Standard is now available for review at their web site at <http://www.osha-slc.gov/SLTC/ergonomics/ergoreg.html>. In the program, OSHA has identified the following critical elements: management leadership and employee participation, hazard identification and information, job hazard analysis and control, employee training, medical management and program evaluation. Also to be included in the rule is a grandfather clause for existing programs.

OSHA plans to publish its proposal in the Federal Register in September 1999. Currently this spring and summer, the rule is going through small business and governmental review. Their goal is to take public comments,

hold hearings in several cities in late 1999 and publish a final rule in 2000.

If you take a look at the working draft, it seems quite different from the OSHA standard we are accustomed to. It is a product of the Plain Language Initiative. On June 1, 1998, President Clinton issued a memorandum for the heads of executive departments and agencies directing the use of plain language in government. Plain language includes logical organization, easy-to-read design features and the use of common everyday words, pronouns, the active voice, and short sentences. For more information on the president's initiative check out <http://www.plainlanguage.com>, or check out a copy of the president's memo at <http://www.npr.gov/library/direct/memos/memoeng.html>.

Also as a part of the Plain Language Initiative, OSHA conducted a line-by-line review of its standards, and committed the Agency to eliminate those found to be unnecessary, duplicative, or inconsistent and to rewrite those found to be complex and outdated. The Agency's dip-tank standards were identified by that review as needing clarification. The Final Rule of Dipping and Coating Operations, effective April 22, 1999, was published in the Federal Register 64:13897-13912. The final rule does not change the technical substance of the former standards or alter the regulatory obligations placed on employers or the safety and health protections provided to employees. OSHA believes the performance-oriented language of the final rule will facilitate compliance because it gives employers more compliance options than they had under the former standard. The final rule can be viewed at <http://www.osha-slc.gov/FedReg/oshadata/FED19990323.html>. ♦

Regulatory Update

DISPOSAL OF RADIOACTIVE MATERIALS: COST AND ESH CONSIDERATIONS

Many aircraft components contain low-level radioactive materials. Acquisition personnel should be aware of the regulations governing these materials and understand where the materials are contained in existing weapon systems. Whenever possible, design engineers should avoid specifying radioactive materials because of the higher costs and regulatory complexity associated with each stage of the components' life cycle.

Several agencies regulate radioactive materials. The Nuclear Regulatory Commission (NRC) granted a Master Material License to the Air Force for use of radioactive material. Under the license, the Air Force is given authority to manage *those* radioactive materials that the NRC regulates. The Air Force Radioisotope Committee (RIC), located within the Air Force Medical Operations Agency at Bolling AFB DC, issues individual permits for the use of radioactive material at Air Force installations. NRC guidance is found throughout Title 10 Code of Federal Regulations, "Energy", parts 0 to 199. There are three types of NRC authorizations (specific license, general license, and exempt distribution, where in no license is needed)

and two types of Air Force radioactive material permit categories (specific, general). Air Force organizations must secure a permit from the USAF Radioisotope Committee (RIC) before receiving, storing, distributing, using, transferring, or disposing of radioactive materials as defined in AF 40-201, Managing Radioactive Materials in the Air Force. AFI 40-201

governs each of these activities plus incident management and reporting. RIC is maintained by the Surgeon General (HQ USAF/SG) and is under the direction of the Air Force Medical Operations Agency. The Department of Transportation's (DOT) regulations establish criteria for the safe transport of radioactive materials. These regulations are found in Title 49 CFR Part 171 through 178 and are cross referenced in the NRC's 10 CFR part 71. The Environmental Protection Agency's (EPA) Radiation Protection Programs impose limits on radiation exposures, levels, concentrations, or quantities of radioactive material received by members of the public. EPA also has joint authority with NRC over the disposal of low level radioactive material mixed with hazardous waste (40 CFR Part 261).

A wide variety of products used at Air Force bases contain radioactive materials including chemical agent alarms, self-luminating exit signs, smoke detectors, and medical products. Table 1 provides examples of radioactive materials contained in weapon systems.

Several incidents of improper management and disposal of radioactive mate-

rials have occurred. In some cases, recycling or disposal companies have discovered radioactive materials in scrap metal that they received from Air Force bases. The remediation and disposal costs associated with radioactive wastes are very high. One way to prevent such incidents in the future is for acquisition managers to avoid the use of radioactive materials during the design process. Acquisition staff should consider the use of exempt distribution components or non-radioactive items. In fact, USAF's radioactive material acquisition policies include: 1) acquisition of radium or devices containing radium is prohibited, 2) radioactive material can not be accepted into the USAF inventory unless an USAF permit issued by the RIC exists or the material is exempted from permit requirements by the RIC or AFI 40-201, 3) systems using radioactive materials must have radiation safety features built-in by design, 4) radiation safety requirements must be specified in all contracts awarded for operating, changing, and repairing systems containing radioactive materials. For further information, contact Major Larry Donovan, DSN 787-2618, HQ AFMC/SGCR. ♦

Material	Type of License/CFR	Type of Radiation
Byproduct Material		
Krypton-85 Nucleonic Oil Gauges: C-5, F-111, F-106	Specific; 10 CFR 30	Beta Gamma Emitter
Inflight Blade Integrity System (Strontium-90)	General; 10 CFR 31	Beta Emitter
Luminous Safety Devices for Use in Aircraft (Tritium)	General; 10 CFR 31.1	Beta Emitter
Lensatic Compasses (Tritium)	Specific; 10 CFR 30	Beta Emitter
Light Antitank Weapon Rocket, Sights (Promethium-147)	Specific; 10 CFR 31	Beta Emitter
Strontium 90 Ice Detection Device	General; 10 CFR 20	Beta Emitter
Americium 241 Lantirn POD, F-15/F-16	Specific; 10 CFR 30	Alpha, X-Ray Emitter
Carbon 14 Light Source in Inertial Guidance System in B-2	Specific; 10 CFR 30	Beta Emitter
Source Material		
Depleted Uranium Counterweights: C-141, C-5, A-7* (*Possession and use only; no authorization for cutting)	No license or permit needed; 10 CFR 40.13, 10 CFR 20	Alpha, Beta, X-Ray Emitter
GAU 8 Depleted Uranium Munitions Used in A-10 and A-16 30 MM	Specific; 10 CFR 40	Alpha, Beta, X-Ray Emitter
ALCM/GLCM Depleted Uranium Physics Package (Simulated Warhead)	General; 10 CFR 40.22	Alpha, Beta, X-Ray Emitter

Examples of Radioactive Materials in AF Weapon Systems

Regulatory Update

FIRST AIR FORCE SALE OF EMISSION REDUCTION CREDITS UNDER NEW PILOT PROGRAM - Margaret Gidding

The Air Force (AF) has made the first ever sale of emission reduction credits by a military service. The sale of 12 pounds of nitrogen oxide (NOx) emission reduction credits by March Air Reserve Base (ARB) gave the base \$58,971.00 that will go towards testing two new pollution prevention technologies.

Acting under a two year pilot program that allows local military bases to retain net proceeds from the sale of reduction credits, March ARB will use the money earned from the emission reduction credits towards supporting two other pollution prevention technologies that would not otherwise be qualified for traditional funding avenues.

Interesting enough, if both of these technologies are proven in the field, they will be applied to generators there and will create additional credits that can be sold by the AF base. In addition, the technologies could have far reaching positive impacts on the environmental issues throughout the AF.

The pilot program came about through special legislation in the FY97 DoD Authorization Act and was patterned after existing recycling authority. The purpose is to create an economic incentive for the bases to recover some of the costs of pollution prevention projects. The Dept. of Defense has issued implementation guidance for the program to all the services.

Kathleen Smith, chairperson of the Clean Air Act Services Steering Committee (Subcommittee on Emissions Trading), helped draft and sponsor the legislation and the DoD implementing guidance. According to Ms. Smith, "this is a very exciting program that

will provide the monetary incentive and encouragement for bases to further explore air pollution prevention measures that will help us ensure and further extend the AF's commitment to responsible environmental stewardship."

As an environmental engineer who helped make this happen at March ARB, Mr. Vistasp Jijina commented, "The pilot program, as implemented by the guidance document, provides the base level engineer the freedom to think outside the box as it applies to reducing air pollution above and beyond the regulatory requirement. By doing so, technologies that otherwise would not have been considered can be researched and used thus enabling the Air Force to exhibit environmental leadership."

The 1990 Clean Air Act Amendments (CAAA) require emission reductions by military and civilian activities all over the nation in order to meet the national ambient air quality standards for clean air. The CAAA introduced the marketplace into environmental control programs. To encourage innovative approaches to the reduction of air pollution, the CAAA authorized development of state programs to trade emission reductions where a source has gone beyond what is legally required. Various state trading programs have been started in over 27 states on both coasts and in Texas. Also, the U.S. approach to greenhouse gas control is based on emissions trading. ♦

Q&A FROM THE FIELD

Q. Our Plastic Media Blast facility uses cartridge type filters and was constructed back in 1991-1993 timeframe – long before EPA de-

veloped Method 319. Our facility was source tested (Method 9) in order to demonstrate compliance with both BACT and Toxic NSR. I also have penetration curves from the filter manufacturer showing the control efficiency at various particle sizes. The efficiencies are much higher than those required for existing sources under the NESHAP; however, the testing was not done per Method 319. At the recommendation of our Air Pollution Control District, I contacted CARB to find out how to obtain an equivalency determination. Switching to Method 319 certified filters is not an option because it would decrease the control efficiency, and the district permit allows us to use only the specific type of filters which were source tested. According to CARB, this situation has not previously occurred in Region 9. I am curious as to whether anyone else out there has been in a similar situation, with either painting or depainting, and how it was resolved?

A. Baghouse (including cartridge filters) is an acceptable inorganic HAP control option. Efficiency specifications do not apply and filter certification is not required. A performance test is not required.

A similar question was posted on EPA's open forum: <http://www.epa.gov/cgi-bin/netforum/uatw/a/3-24>. ♦

Design for the Environment

RECYCLABLE ENERGETIC MATERIALS BASED ON THERMOPLASTIC ELASTOMERS

Today's rocket and gun propellants can generally be classified as thermoset materials. Thermoset materials provide high mechanical strength and long storage life but have a relatively high environmental cost, especially at the end of their life cycle. Recent developments have demonstrated a new generation of energetic materials based on thermoplastic elastomers (TPE). TPE propellants have been demonstrated to achieve the desired system performance as well as offer thermal recycling of the material throughout the life cycle.

Much of the currently fielded propellant technology was developed in the first half of the 20th century. During this time, two categories of propellant materials evolved which are commonly known as composite and double based propellants. Composite propellants are generally a solid oxidizing material loaded into a relatively low energy binder that supplies the fuel while double based propellants are usually solvent based nitrocellulose and nitroglycerine containing materials. Both of these propellant types are generally classified mechanically as thermoset polymers. Thermoset polymers have a single set life in which a curing agent creates a highly crosslinked solid matrix which can not be reworked. The environmental impact of these materials is significant throughout the life cycle: from the manufacture, to when production errors occur, to the end of the weapon systems life. Processing of many of these materials often use undesirable solvents and curing agents. All spare, scrap, or wasted material must be destroyed. Demilling requires destruction of the material through combustion or costly chemical reclamation processes.

Marked progress in polymeric technology has been achieved in the last sev-

eral decades. One of the key areas of advancement has been in the development of TPEs which have the desired flexibility at cold temperatures, retain good structural integrity over a relatively wide temperature range and melt at temperatures low enough to allow safe processing of energetic compositions. This has led to the development of new composite propellant technology based on energetic solid loaded TPE materials that achieve the required system performance and are completely recyclable.



TPE Propellant

One of the leaders in the development of TPE propellant materials has been Thiokol Corp. through a series of Army Research Laboratory (ARL) and Office of Naval Research (ONR) contracts starting 15 years ago. The development of a composite propellant based on a TPE binder system was relatively straightforward. The real technical challenge came in finding energetic TPE materials that were mechanically tough enough to survive the combustion environment and achieve the system performance requirements. The search eventually came to a class of TPEs called oxetanes. Oxetanes are polyether block copolymers that are joined together with urethane linkages to form TPEs with relatively unique properties. Oxetane TPEs may be either energetic or non-energetic in nature, thereby allowing the propellant or energetics formulator the ability to use the polymer to tailor the final properties of the composition.

The ability to tailor mechanical properties to achieve performance with TPE oxetane propellants is considered a highly desirable system characteristic. However, the real driving force behind the development of TPE propellant technology has always been the significant environmental advantages that could be achieved. The environmental benefits that have been demonstrated using TPE based compositions include:

- 1) Solventless processing
- 2) Reuse of production scrap – zero production waste
- 3) Reprocessing of out-of-spec lots to meet specifications
- 4) Demil reuse via re-extrusion into different forms (i.e. different geometries of propellant grains)
- 5) Reprocessing modification of the base compositions via addition of new ingredients to meet new performance specifications

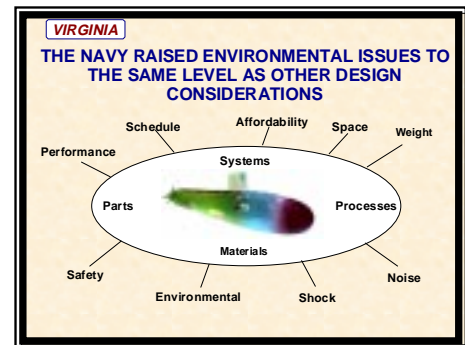
The TPE propellant technology has recently been moving out of the research and development (6.2) phase and into several significant advanced development (6.3) programs that have looked at TPE propellant for application into future weapon systems. In the Army/DTRA ETC Direct Fire Program, TPE propellant was used to demonstrate significant performance improvements in the Army 120mm tank gun. The Navy's Green Energetic Materials (GEMs) program has investigated TPE materials for gun propellants, explosives, and rocket propellants for several Navy systems under development. In all programs, the ability to recycle the TPE propellant has been demonstrated and proven to offer significant cost savings. Interest in TPE propellant technology remains high throughout the energetic materials community. Future program applications could lead to a fielded TPE propellant system as soon as 2005. ♦

DoD Cross-Feed

NAVY P2 IN ACQUISITION: NEXT GENERATION ATTACK SUBMARINES

NAVSEASYS COM has successfully incorporated pollution prevention principles throughout the design phase of the new VIRGINIA Class submarine. The Navy Acquisition Organization is working closely with the Environmental Program to ensure that the acquisition community considers life-cycle environmental factors in new weapon systems acquisition. The VIRGINIA Class submarine is one of several similar on-going projects in this arena.

The development phase of the VIRGINIA Class submarine project began in 1993. The first new submarine is scheduled to be deployed in 2006 and will be retired and scrapped after approximately 30 years. The VIRGINIA Class environmental program established a pollution prevention strategy early on in the design process. By raising environmental issues to the same level as other design considerations, engineers were able to give environmental impacts equal attention. At the same time, it helped determine if the platform will meet environmental requirements with minimal impact on readiness, cost, and schedule. The environmental program's strategy consisted of the following:



- Create a life cycle environmental management team — the VIRGINIA Class submarine project involved the full spectrum of organizations that will be involved in every stage of the new submarine's life cycle and included: the Acquisition Program Manager, the Navy technical design codes, maintenance organizations, shipbuilders, operating forces, supply command, and the disposal shipyard.
- Develop a pollution prevention strategy — the pollution prevention strategy served as a basis for evaluating environmental concerns. The major objectives are to find acceptable alternatives to hazardous materials wherever possible and to comply with all applicable environmental requirements.
- Develop an environmental compliance team and an environmental implementation plan — The main contractor, the Electric Boat Corporation (EB) formed an environmental compliance team and a four-part implementation plan that contains: 1) a plan for training all Design/Build teams in pollution prevention and compliance; 2) an assessment of laws and regulations for the VIRGINIA life cycle; 3) an environmental analysis on a ship-system basis; 4) a hazardous material map identifying the location of hazardous material.
- Coordinate with Puget Sound Naval Shipyard (PSNS) on the preparation of a disposal plan — the VIRGINIA Class submarine is unique because it has been designed with the end-of-life recycling process in mind. PSNS educated team members about the circumstances that can prevent the shipyard from being able to fully recover valuable materials for recycling. For example, materials that are not considered hazardous during construction are hazardous waste at the time of disposal.
- Design Environmental Analysis Tools — At the macro-level, the team worked with PSNS to address these issues by designing four tools to guide the choice of materials used in constructing the submarine: an environmental analyses, a disposal plan, a Hazardous Material map, and a refurbishment / reuse/ recycling program. The system-level environmental analysis tool enabled designers to identify hazardous materials and to find ways to reduce them. The analysis included a detailed portrayal of the hazardous material inputs and outputs associated with the submarine, an assessment of alternative materials, and opportunities for refurbishment and reuse. Any hazardous materials that could not be eliminated are captured in the database in the HAZMAT Map. The HAZMAT Map identifies the location of hazardous materials at the level of individual parts so that the materials can be tracked throughout their life cycle — through home port maintenance requirements, disposal, and recycling. The HAZMAT Map assists disposal operations by providing detailed information on where hazardous material is located on the ship.

The VIRGINIA Class submarine project demonstrates a pioneering, and successful approach for incorporating environmental considerations in a major new weapon system. As a result, the new submarine will have greatly reduced environmental impacts throughout its life cycle while still performing its intended mission.

A case study related to this initiative is available on the MONITOR website: <http://www.ascem.wpaafb.af.mil/monitor.htm>. ♦

DoD Cross-Feed

IMPROVING ACQUISITION AND DEPOT MAINTENANCE OPERATIONS

In October 1998, Joint Logistics Commanders (JLC) took a bold step toward winning the battle against pollution. They reorganized the Joint Group on Acquisition Pollution Prevention and combined it with the pollution prevention mission of the Joint Policy Coordinating Group on Depot Maintenance to form the Joint Group on Pollution Prevention (JG-PP). This group becomes the focal point for the Military Services and NASA to combine resources in the fight to prevent pollution.

Many original equipment manufacturers (OEMs) manufacture multiple systems at a single facility to meet the requirements of their Department of Defense (DoD) and other government customers. In addition, supporting maintenance facilities often serve more than one system. Since specific system requirements evolve at different times and are targeted to meet a diverse set of objectives, program managers are often forced to operate under different system specifications, different budget profiles, and different time deadlines to meet their individual objectives, including pollution prevention objectives. Previously, no joint pollution prevention interface was available to integrate shared needs for the Services and NASA program managers, process owners, and their contractors to coordinate common pollution prevention objectives. This created the potential for duplication of effort and costly delays for implementing changes. The JG-PP mission is to address these issues and facilitate change in the uses of hazardous materials (HazMat) and processes.

The JG-PP is composed of Command Flag Officers and Directors from each service, including the Marine Corps, the Defense Logistics (DLA), and HQ National Aeronautics and Space Administration (HQ NASA). The group will coordinate joint service/agency activities affecting pollution prevention issues identified during weapon system and NASA system acquisition manufacturing and sustainment maintenance processes. The JG-PP members are as follows:

- RADM Andrew Granuzzo, Navy
- MG John S. Caldwell, Army
- Maj Gen Timothy P. Malishenko, DLA-DCMC
- Ms. Olga Dominguez, NASA
- Brig Gen Stanley A. Sieg, Air Force
- Mr. Ken Trammell, Marine Corps

The JG-PP will support the reduction/elimination of hazardous materials by fostering joint service/agency cooperation at design, manufacturing, re-manufacturing and depot maintenance process locations that affect DoD and NASA systems. To avoid duplication in reducing HazMat uses, the JG-PP will facilitate joint implementation of various executive orders and DoD and NASA policy directives. The JG-PP will accomplish this through a working level group known as the Joint Acquisition Sustainment Pollution Prevention Activity (JASPPA).

JASPPA combines the resources of the former Joint Pollution Prevention Advisory Board (JPPAB) and the Joint Depot Environmental Panel (JDEP). This activity is composed of working level representatives from the Military Services and NASA. The JASPPA provides the engineering, technical, and business services required to pursue pollution prevention needs of the Military Services and NASA. The JASPPA facilitates pollution prevention projects by establishing partnerships among industry contractors; affected weapon system program managers and depot process owners; NASA center and enterprise managers; and the Defense Contract Management Command (DCMC). Throughout the process, participants cooperate to identify needs, determine alternative engineering performance requirements, and validate alternatives to HazMat usage. Once engineering authorities have validated an alternative, the alternative may be implemented. OEMs will submit concept papers to utilize the Single Process Initiative (SPI) block change process to modify contracts for implementation across all affected systems and components. Depot sustainment maintenance activities will utilize their respective service/agency change mechanism for implementation.

The JG-PP activities are an integral part of the identification, technical, and business phases of the Acquisition Pollution Prevention Initiative (AP2I). AP2I was chartered by the Principal Deputy Under Secretary of Defense (Acquisition & Technology) on May 15, 1997, and assigned DCMC to lead the initiative. AP2I provides defense contractors with an accessible means to improve their manufacturing operations by reducing costs, eliminating or reducing emissions of hazardous materials, and minimizing the use of multiple material specifications.

JG-PP, the objective of AP2I is to reduce or eliminate the use of hazardous materials. In summary, JG-PP complements AP2I by facilitating working partnerships among contractors, maintenance process owners and affected weapon system and NASA programs.

Many JG-PP/AP2I project results can be leveraged to start new and similar pollution prevention projects. By utilizing the results from completed projects, new projects can take advantage of the JG-PP materials/products (i.e., joint test protocols, joint test reports, etc.) already developed to accelerate the progress of a new project and reduce their financial risk. This aspect of leveraging results also further reduces the potential for duplication of effort within government and industry.

Current JG-PP-sponsored AP2I projects (see related article on [page 25](#)) are helping to reduce and even eliminate worker and war fighter exposure to hazardous materials as well as decrease costs associated with product manufacturing, equipment maintenance, and material specification management.

Source: NDCEE Fact Sheet ♦

Sites (# of sites)	Identification	Technical	Business	Alt Dem/Val	SPI	Implementation
Ray-Texas Inst (3)	VOCs in Primers and Topcoats					
Ray - Hughes (1)	Non-Chrome Conversion Coating - Terminated, No Alternative - New project being considered					
Boeing - B-A&M (1)	Non-Hexavalent Chromate Primer					
P&W (1)	Non-Zinc Chromate Primer for Fasteners					
L-M (6)	VOCs in Topcoats and Primers - Discontinued, Little LM Support					
	VOCs in Ink/Paint Stenciling					
PEWG (5)	Lead in Dry Film Lubricants					
Boeing - BISDS (4)	Cadmium Plating					
CCAMTF (4)	VOCs in Conformal Coatings and Lead in Surface Finishes					
Raytheon - ES (3)	Chrome/VOCs in Topcoats and Primers					
Landing Gear (4)	Hexavalent Chrome					
Hamilton Std (1)	Hexavalent Chrome					
Ammo (4)	VOCs in Topcoats					
NAVSEA (1)	VOCs in Non-Skid Surfaces					
NAVSEA (1)	VOCs in HAPs in Tank Coatings					

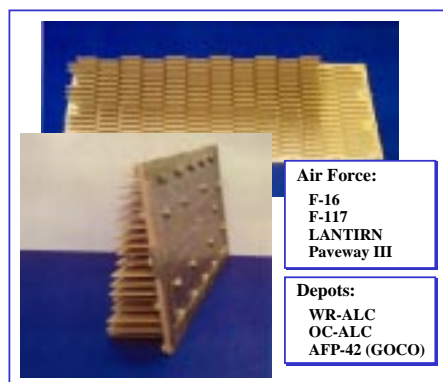
Status of JG-PP Projects

DoD Cross-Feed

JOINT GROUP ON POLLUTION PREVENTION (JG-PP) PROJECT UPDATE

In October 1998, the JLC approved a change to the JG-APP charter to enlarge the scope of their work to include the service depots and NASA (see related article on [page 23](#)). At that time, the "A" for Acquisition was dropped and the new, expanded group became the Joint Group on Pollution Prevention (JG-PP). Details related to JG-PP projects are provided below.

VOC in Primers and Top Coat (Raytheon Systems Company):



The objective of this project is to eliminate Volatile Organic Compounds (VOCs) in topcoats and primers and provide a non-VOC, non-hazardous alternate material for applications using MIL-C-46168. The initiative was started in August 1995 and the first technical block changes were completed in 1998. The estimated Return on Investment (ROI) associated with this project is less than 4 months.

Non Chrome Conversion Coating (Raytheon Company – Hughes): The objective of this project was to qualify a non-chromate conversion coating and test the associated corrosion resistance, paint adhesion, and electrical resistance properties. The project began in October 1994 and was terminated in 1997. The alternatives down selected failed the pre screening testing criteria. A project by NCMS is underway with a potential of developing a new JG-PP non-chromated conversion coating

project in late FY00.

Non Hexavalent Chromate Primers (Boeing Aircraft and Missiles): The objective of this project is to eliminate hexavalent chromium and reduce VOCs in primers that are used on aircraft outer mold line for various weapon systems. Laboratory testing for the alternatives selected was completed in December 1997 and flight testing, which began in February 1998 will be completed by February 2000. Thus far, the new primers are doing well.

Non Zinc Chromate Primers for Fasteners (Pratt & Whitney): The objective of this project is to replace chromium, as contained in zinc chromate primers, on engine inserts and fasteners. Testing on the selected alternatives (Alumazite ZDA, TT-P-645B ZincMolybdate, and TT-P-664D High Solids) was completed in April 1998 and the block change was completed in June 1998. This technology was provided to GEAE as well to implement in GE engines.

VOC in Ink/Paint Stenciling (Lockheed Martin): The objective of this project is to eliminate conventional wet-spray coating and brush coatings used traditionally for ink and paint stenciling. Currently, two alternatives are ready for testing. The ROI is approximately 6 months for this project.

Lead in Dry Film Lubricants (Propulsion Environmental Working Group): The objective of this project is to eliminate lead as contained dry film lubricants to aid in assembly and disassembly and/or antigalling. The Joint Test Protocol (JTP) for this project was published in October 1997, testing, which began in September 1998, is currently in progress. The ROI for this initiative is 1.1 years.

Cadmium Plating (Boeing Information, Space, and Defense Systems):



The objective of this project is to eliminate electrodeposited cadmium in metal plating on threaded fasteners, gears, and cabinets. The project was started in July 1996 and the associated JTP is being finalized for testing. Tin-Zinc plating that has been identified as the alternative for testing.

VOCs in Conformal Coatings and Lead in Surface Finishing (Conformal Coating and Material Task Force): The objective of this project to develop the guidelines for conformal coat usage and validate low VOC conformal coatings. The JTP has been completed and testing, which is underway, should be completed by August 1999. The ROI in industry for this initiative is 1.5-5.3 months.

Chrome/VOCs in Top Coats and Primers (Raytheon Electronic Systems): The objective of this project is to eliminate chromium in primers and reduce VOCs in top coats. The stakeholders have accepted the JG-PP qualified alternative and implementation of the process has been completed.

Hexavalent Chrome (Landing Gear): The objective of this project to replace hexavalent chrome with tungsten carbide cobalt on external bearing surfaces. The landing gear manufacturers and the Canadian National Defense are stakeholders in the project. The JTP for this initiative has been drafted.

DoD Cross-Feed

Hexavalent Chrome (Hamilton Standard): The objective of this project is to replace hexavalent chromium with tungsten carbide alloy in two T-56 engine 56H60 propeller hub parts at WR-ALC based on Hamilton Standard's experience. The kick off meeting for this project occurred with Hamilton Standard in May 98 and a draft JPP has been prepared.

VOC in Topcoats (Ammo): The objective of this project is to replace top coat paint on 20 mm, 25mm, 30mm,

and GAU 8 Munitions. The project began in October 1997 and testing schedule is being developed.

VOC in Non-Skid Surfaces (NAVSEA): The objective of this project is to develop a lower VOC solvent content with a longer life than MIL-PRF-24667. Under this project, four separate areas will be coated on the U.S.S. Russell using four product combinations. NAVSEA plans to evaluate coated areas after 18 months and then again after 24 months.

VOCs in HAPs in Tank Coatings (NAVSEA): The objective of this project is to demonstrate and validate a lower solvent based epoxy coating that is commercially available. The selected coatings will be used in critical shipboard applications such as seawater ballast tanks and well deck overheads.

The latest information on JG-PP projects and activities can be found on their website at www.jgpp.com. ♦

Technology

AN ADVANCED ENVIRONMENTAL AIRCRAFT BATTERY (EAB) ELIMINATES CADMIUM AND LEAD FROM OPERATIONAL BATTERIES

For military airborne and ground applications, the mainstay in rechargeable batteries has been the vented nickel-cadmium battery, which due to the heavy maintenance and upkeep requirements, has cost the Air Force an estimated \$50 million per year. Advances in sealed ultra low maintenance and maintenance free batteries have been transitioned into operational aircraft and many current systems use low or no maintenance batteries to reduce the operational costs.

Environmental concerns in the public sector resulted in development of "green" batteries for portable commercial products. These batteries use either a metal hydride substitute for the cadmium electrode in portable nickel-cadmium batteries or the newer lithium-ion technology, which totally replaces the nickel-cadmium battery with advanced technology. Both of these new batteries are commercially successful and are projected to eliminate the nickel-cadmium battery from many commercial applications within the next five years. However, military weapon systems require more stringent capabilities than small portable commercial batteries, hence emphasis was

placed on sealed reduced maintenance and longer life batteries to reduce operational costs and minimize use of environmentally hazardous lead and cadmium. Currently many military systems today use low maintenance concepts such as the Advanced Maintenance Free Aircraft Battery System (AMFABS) [*Monitor*, 5 (3), p. 5 (June 1998)] or sealed lead acid (SLA) batteries in these applications. Unfortunately, these batteries use HAZMATs on the EPA 17 list for elimination from use in the US. The Secretary of the Air Force supported the minimization and/or elimination of these materials in the SAF/AQ Acquisition Policy Memorandum 94A-003, 23 Aug. 1994. However, there are no environmentally acceptable alternative batteries that meet EPA requirements, comply with the HQ USAF policy and meet user performance requirements.

The Air Force Research Laboratory Battery Branch (AFRI/PRPB) proposed development of a nickel-metal hydride replacement for all existing sealed and vented nickel-cadmium and SLA batteries currently used in Air Force aircraft in 1994. Initial environmental funding support was obtained

through the Strategic Environmental Research and Development Program (SERDP) for an evaluation of the commercial technology [WL-TR-96-2069, Apr 96]. Subsequently ASC/ENV supplied funds to develop the prototype environmental replacement battery targeted at the F-16 Pre Block 40 Main Aircraft Battery. This program completed Phase I in August 1998 and evaluated cell and battery design modifications and metal hydride, electrolyte and nickel electrode materials for incorporation into single cells and batteries manufactured and tested in Phase II. Both prismatic and bipolar cell designs were under consideration for the final battery design. The results of single cell tests were presented during the Task 3 program reviews on 30 and 31 March 1999, which resulted in a prismatic design selection. Batteries and associated interface electronics will be fabricated and delivered for laboratory testing in the second quarter of FY00. Projects of the battery capability indicate the Ni-MH technology will 1) meet operational performance parameters from -40 to +70 degrees centigrade; 2) have less than 25 percent self discharge up to 50 degrees centigrade; 3) deliver 46 Amp-hours of

Technology

capacity versus the existing 17 Amp-hour battery and 4) have the same weight. Upon completion of satisfactory laboratory tests, prototype production batteries will be manufactured in a separate contract during Phase III and delivered for flight test and qualification in the third quarter of FY01.

Based on a successful flight program the environmental aircraft battery (EAB) technology can be configured to meet all existing aircraft battery requirements for the Air Force and is designed to be compatible with existing charging systems and hardware, such as the AMFABS, with no or minimal charger modifications. Insertion of

the EAB into the fleet can be accomplished either as a preferred spare or whenever an equipment upgrade is planned.

For further information about this technology please contact Dr. John K. Erbacher, AFRL/PRPB, at DSN 785-7770. ♦

OC-ALC IMPLEMENTS A NESHAP COMPLIANT CHEMICAL PAINT REMOVER

Oklahoma Air Logistics Center (OC-ALC) is responsible for depainting KC-135, B-1, B-52, and E-3 aircraft. Historically, the depot has used a methylene chloride stripper to depaint 80 aircraft/per year. This process generates approximately 400,000 lbs. of hazardous air pollutant (HAP) emissions per year. The new National Emission Standard for Hazardous Air Pollutants (NESHAP) rule impacts this process and has required the depot to investigate alternatives.

OC-ALC Primary Mission	
➤ Depot maintenance on -135, B-1, B-52, E-3, and E-6	
➤ Repair/overhaul/test aircraft engines, cruise missile engines, and related commodities	
➤ Manufacture of aerospace parts and production support tooling	
Aircraft Depainting - Paint Systems	
➤ Past	<ul style="list-style-type: none"> • Polysulfide primer • Epoxy primer (MIL-C-23377F T1/C1) • Polyurethane topcoat (MIL-C-83286) • Old koroflex primer (TT-P-2760A)
➤ Present	<ul style="list-style-type: none"> • Koroflex polyurethane primer (TT-P-2760) • Epoxy primer (MIL-C-23377, CC) • Self-priming topcoat (TT-P-2756) • Polyurethane topcoat (MIL-C-85285)
ESOH Drivers	
➤ NESHAPS Aerospace rule - depainting	<ul style="list-style-type: none"> • 50 gallons or 365 lbs of HAPs/military aircraft/yr for spot and decal stripping
➤ SARA (TRI) reporting requirements	<ul style="list-style-type: none"> • AF '99 goal: reduce purchases and releases by 50%
➤ OSHA PEL: 25 ppm for methylene chloride	

One of OC-ALC's recent successes has been the implementation of a NESHAP compliant chemical paint remover. Eldorado PR 3170/5000 (aka PR 5555), a two component stripper, replaces the traditional non-compliant methylene chloride paint removers used at OC-ALC. Details related to the two-year team effort to qualify and implement the use of a NESHAP compliant chemical paint remover are summarized below:

Overview of the Process to Develop an Alternative Chemical Stripper: Historically, the qualification criteria for chemical paint removers at OC-ALC have been very stringent. As a result of the new NESHAP regulations, OC-ALC recognized the need to revise the traditional paint removal purchase description. An engineering team consisting of TIP, LAP, and weapon system personnel have worked diligently to revise the purchase description.

The qualification process involved selecting the best candidates based on performance, prototyping the candidate on an aircraft, obtaining approval from the Single Manager to implement, and conducting an industrial waste compatibility test to ensure the successful integration of the new process with OC-ALC's current waste treatment operations.

The qualification process identified Eldorado PR 3140/5000 and PR 3170/5000 as the top two candidates, based on performance. Further performance evaluation revealed the PR 3170/5000 was more effective for paint removal than the PR 3140/5000. The corrosion data was reviewed by the KC-135, E-3, and B-53 weapon systems Single Managers and the PR 3170/5000 was approved for use on all KC-135 and E-3 aircraft. Use of the material on the B-52 is approved on a case by case basis.

The two part stripper is mixed at the spray nozzle and has a dwell time of 3 to 12 hours and requires rewetting of vertical surfaces. Additionally, it requires ambient temperatures of greater than 60 degrees F for good stripping benefits. OC-ALC has already stripped over 100 aircraft and numerous component parts. The paint systems removed include polyurethane (TT-P-2760), epoxy (MIL-P23377) primers, self-priming topcoat (TT-P-2756), and polyurethane topcoats (MIL-C-85258).

Benefits of the Alternative Chemical Stripper: Eldorado PR 3170/5000 is expected to eliminate 595, 000 lbs./yr. of methylene chloride based stripping compound that is used to strip C/KC-135, E-3, and B-52 aircraft. The new material is less labor intensive and requires very little labor to remove the bonded paint. Additionally, it ensures that OC-ALC meets its 1999 TRI goals and complies with the NESHAP for depainting of military aircraft.

For further information regarding this substitution, please contact Mr. Kevin O'Connor at DSN 336-5958. ♦

Acquisition Phase: Disposal

THE ULTIMATE RECYCLING AND REUSE FACILITY: THE AIR FORCE AEROSPACE MAINTENANCE AND REGENERATION CENTER (AMARC)

Do you ever wonder what happens to surplus aircraft? Established in 1946, the Air Force Aerospace Maintenance and Regeneration Center (AMARC) located at Davis-Monthan airfield is a 2,600 acre storage facility situated in the Arizona desert. Referred to by Tucson locals as the “graveyard”, AMARC stores aircraft so that they can be returned to active service when needed, reclaimed for parts, or sent for disposal. The facility stores aircraft and other equipment primarily from the Air Force, Navy, and Army. In 1998, AMARC had approximately 5,000 aircraft in its inventory worth over \$27 billion in assets ranging from B-52s to F-15s.

AMARC has played a vital role in every major conflict that the United States has fought, including the Korean war, the Vietnam war, and most recently, Desert Shield/Storm. AMARC provided thousands of critical parts, returned aircraft to service, and processed aircraft into storage as these conflicts wound down.



When aircraft arrive at Davis-Monthan, they are prepared for either short or long-term storage. AMARC has designated four storage categories:

- Long-Term Storage (Type 1000) - maintains the integrity of the aircraft for an extended period of time. The aircraft must be re-preserved every four years. Long-term storage is typically reserved for aircraft that have a high probability of returning to service. Currently, over 1,300 aircraft are in long-term storage.
- Parts Reclamation Storage (Type 2000) - in some cases, it is not desirable to preserve an entire aircraft for eventual return to service. Instead, AMARC may choose to maintain the integrity of only certain valuable, high-demand parts/components prior to their removal and return to active service. Over 2,000 aircraft are in parts reclamation storage.
- Flyable Hold Storage (Type 3000) - the shortest storage period is for 90 days. AMARC maintains these aircraft in active flying status. Flyable hold storage also applies to FMS/Security Assistance Program aircraft pending sales/transfer in 90 days.
- Excess to DoD Requirements (Type 4000) - excess aircraft are used for general parts reclamation, as targets, or as static displays. Some are sent for disposal through DRMO. Currently, over 1,200 aircraft are in excess.

Historically, over 21% of AMARC aircraft are withdrawn from storage with many returning to flying service. The inventory includes jets, turboprops, reciprocating engine-powered fixed and rotary wing aircraft. Through its reclamation services, AMARC removes parts and assemblies from stored aircraft to support flying operations. Parts can be reclaimed on either a priority removal basis or through programmed reclamation. AMARC can supply parts to meet urgent and unforeseen requirements that can not be satisfied through normal supply and requisition channels. Under programmed reclamation, AMARC restocks supply shelves and meets long-range forecasts on a routine basis. AMARC has a full-service maintenance shop with a large staff of trained, and certified aircraft maintenance experts. In 1998 alone, over 28,000 parts were reclaimed.

Aircraft may either leave the storage facility under their own power (i.e., flyaway), or may be transported overland. In 1998, 51 aircraft flew away including twenty five F-4s and ten KC-135s. In contrast, over 147 aircraft left overland including fifty-four H-1 s, twenty-two T-34s, and sixteen H-2s. Some aircraft are sold to foreign militaries after AMARC removes all the DoD classified equipment. Since 1992, 425 aircraft have been sold. Aircraft may eventually be disposed of through DRMO after all the valuable parts and components have been reclaimed. In 1998, 220 aircraft were disposed of in this manner.

Perhaps not surprisingly, AMARC is the single largest aircraft storage and reclamation center in the world. In 1998 alone, its operations resulted in a net cost avoidance to DoD of over \$940 million. If you're ever in Tucson, go for the public tour - it's fascinating! Photos from the AMARC Site Visit, conducted during the 12th Weapon System Pollution Prevention Center Working Group Conference, are available for viewing on the MONITOR website: <http://www.ascem.wpafb.af.mil/monitor.htm>. ♦

Awards

AFMC INSTALLATIONS TAKE TOP HONORS IN SECDEF 1998 ENVIRON- MENTAL SECURITY

AWARDS - *Ecotone Newsletter*

Air Force Materiel Command has "scooped" all other Department of Defense agencies and secured their position as the leaders in environmental excellence with the recent announcement of their selection of four out of seven top environmental awards presented to the Air Force for the 1998 SECDEF Environmental Security Awards. In addition, two AFMC installations also received Honorable Mention for their contributions.

Of the 17 DoD awards announced by SECDEF for 1998, Air Force installations and personnel took top honors in seven areas - four of them to AFMC installations, garnering the command 41 percent of all top honors. The tally for AFMC's environmental top award successes for the past six years now totals 17 of the 31 DoD awards received by the entire Air Force.

The four AFMC installations, two individual environmental specialists and honorable mention recipients follow:

Wright-Patterson Air Force Base, OH
Cultural Resources Management, Individual/Team Award: Dr. Janet E. Ferguson, Cultural Resources Program Manager, Aeronautical Systems Center (ASC), 88th Air Base Wing Office of Environmental Management.

Pollution Prevention - Weapons System Acquisition Team, Honorable Mention: Aeronautical Systems Center, Acquisition Pollution Prevention Team

McClellan Air Force Base, CA
Pollution Prevention Individual/Team Award: Mr. Donald K. Gronstal, Pol-

lution Prevention (P2) Manager, McClellan Air Force Base Air Logistics Center

Robins Air Force Base, GA
Pollution Prevention Industrial/Installation Award

Hill Air Force Base, UT
Recycling Industrial Installation Award

Eglin Air Force Base, FL
National Resources Conservation Award, Honorable Mention ♦

ROBINS EM WINS THIRD DoD ENVIRONMENTAL AWARD FOR POLLUTION PREVENTION - *Linda Larson*



Proudly, Robins' Environmental Management Directorate not only maintains high environmental standards but also surpasses

its anti-pollution goals and achievements year after year, even as the base's industrial workload increases.

Robins has again won the defense-wide Secretary of Defense Environmental Security Award for 1998. The base won the same award in 1997 and 1995.

Brig Gen William M. Wilson, Gregg Beecher, Acting Director of Environmental Management, Mary Kicklighter, Chief of the Pollution Prevention Division, Roger Cannon, Chief of the Hazardous Waste Management Branch, and Linda Larson, Solid Waste Program Manager, were the base's representatives to receive the award. The award was presented by Deputy Secretary of Defense John J. Hamre in Washington DC. A reception at the

Pentagon Dining Room followed the award presentations.

Robins AFB won the award because it has reduced hazardous waste disposal by 41 percent, and toxic releases by 60 percent since 1992. The base reduced municipal solid waste disposal by 57 percent and increased tonnage of recycled waste by 38 percent. Robins' hazardous material exchange program saved \$243,000 in 1997-avoiding disposal of 20,000 pounds of unused materials. They assessed solvent waste streams base-wide to identify opportunities for recycling. Robins enhanced pollution prevention awareness through Earth Day Environmental Awareness Fair, and by establishing numerous integrated product teams and by partnering with the State of Georgia Pollution Prevention Assistance Division. ♦

DOD's WHITE HOUSE ENVIRONMENTAL AWARD WINNER IS "Sowing the Seeds for Change" - *Larry Hill*

The *Joint Service Pollution Prevention Technical Library* is proud to announce that it has received the White House's *Closing the Circle* award in the *Sowing the Seeds for Change* category for the Military. The Library received this prestigious award for its success in sharing the lessons learned across the joint services and its ability to pass these technologies and management practices on to individual installations. By sharing the lessons learned from joint service installations last year, the average Library user found eight alternatives which saved their installation roughly \$2,100 in research time and by implementing these alternatives they saved their installation an additional \$5,200. Several installations reported that by implementing a technology found in the Library, they saved their installation over \$60,000 in one year alone. Cost savings like these make

Awards

the Library a very worth while place to spend your time. Come be a winner with us at <http://enviro.nfesc.navy.mil/p2library>.

The Joint Service Pollution Prevention Technical Library is the only truly *Joint Service* entity as it is backed and funded by all four services, the Defense Logistics Agency (DLA), and the Coast Guard. The Library deals with pollution prevention and compliance

information and is comprised of:

- the Joint Service *Pollution Prevention Opportunity Handbook*,
- the Navy's *Pollution Prevention Equipment Book*,
- DLA's *Environmental Products Catalog*, and
- the Joint Group on Pollution Prevention's *Technical Documents*.

If you have any questions, or would like to receive a copy of the software on CD, contact Mr. Larry Hill at HillLG@nfesc.navy.mil.

The *Closing the Circle Awards* are presented to federal agencies that have demonstrated outstanding achievement in Federal Acquisition, Recycling, and Waste and Pollution Prevention. This year almost 300 nominations were received from 17 Federal agencies. ♦

ASC RECEIVES AN HONORABLE MENTION IN CLOSING THE CIRCLE AWARD FOR "Greening the Government"

Aeronautical Systems Center's Pollution Prevention Branch received an honorable mention in the White House's *Closing the Circle Award* for contributing to "Greening the Government" through its Environmentally-Compliant Part Processing Sequence (ECPPS) Project.



*Mr. Chuck Valley
Program Manager*

The project developed functional comparisons for alloy steel detail processing versus existing non-compliant pro-

cessing sequence. The purpose of this project was to develop and implement a technology transfer plan for the ECPPS, which entailed coordinating an Air Force Logistics Center (ALC) demonstration site, equipment acquisition, installation, demonstration, validation, and training.

Because Ogden Air Logistics Center (OO-ALC) had an annual cadmium and chromium waste stream of about 350,000 pounds per year, ECPPS was presented to the ALC as a partnering opportunity to participate in identifying alternatives to hazardous materials for landing gear details.

The work performed under the ECPPS project proved that Ion Vapor Deposition Aluminum and Sputtered Aluminum processes are truly environmentally friendly alternatives to cadmium plating for high strength alloy steels used on landing gear parts. This unique "green" process will eliminate approximately 350,000 lbs. of cadmium and chromium waster per year. This will ultimately save the Government millions of dollars in life cycle cost for Air Force and Navy aircraft fleets that require continued plating process which were reliant on hazardous materials. ♦

Useful Web Sites

Document	Web Site
MIL-STD-882, System Safety Program Requirements	www.afmc.wpafb.af.mil/HQ-AFMC/SE/ssd.htm
AFMC 91-202, USAF Mishap Prevention Program	afpubs.hq.af.mil/elec-products/pubpages/91-pubs.stm
ASCI 91-201, Mishap Prevention Program	www.asc.wpafb.mil/pubs/asc/instruction.html
AFMAN 91-201, Explosive Safety Standards	afpubs.hq.af.mil/elec-products/pubpages/91-pubs.stm
DoD 6055.9-STD, DoD Ammunition and Explosives Safety Standards	web7.whs.osd.mil/dodiss/directives/direct7.htm
TO 11A-1-47, DoD Explosive Hazard Classification Procedures	bncc.tinker.af.mil/til/tild/TILDT-Home.html#01CD1
Environment Pollution Prevention in Weapon System Life-Cycle Management Hdbk	www.ascem.wpafb.af.mil
AFI 32-7061, The Environmental Impact Analysis Process	afpubs.hq.af.mil/elec-products/pubpages/32-pubs.stm
AFI 32-7080, Pollution Prevention Program	afpubs.hq.af.mil/elec-products/pubpages/32-pubs.stm
AFI 32-7086, Hazardous Materials Management	afpubs.hq.af.mil/elec-products/pubpages/32-pubs.stm

Upcoming Events

Date	Conference	Point of Contact	Phone/Fax/E-mail/Website
17 Jun 99	DoD/Ohio P2 Partnership Meeting, Springfield Air Guard Base, OH	Hugh McAlear, Army REC, Region 5	(630) 910-3213, ext. 224
20-24 Jun 99	Air & Waste Management Association's 92 nd Annual Meeting & Exhibition, St. Louis, MO	Air & Waste Management Association Member Services	1-800-270-3444 FAX: (412) 232-3450 http://www.awma.org/AM99/index.html
21-24 Jun 99	Pollution Prevention Program O&M Course (Satellite)	April Lewis	(937) 255-5654, ext. 3512 e-mail: alewis@afit.af.mil
21-24 Jun 99	The American Electroplaters and Surface Finishers Society, Inc. SUR/FIN 99, Cincinnati Convention Center, Cincinnati, OH	AESF Educational Services	(407) 281-6441
23-25 Jun 99	NDCEE in Process Review, Johnstown, PA	Michael Wrazen	e-mail: Mwrazen@pica.army.mil
29 Jun - 1 Jul 99	1999 Navy/Marine Corps Clean Air Act Conference, New Orleans Marriott, New Orleans, LA	Jennifer Collins	(703) 920-7070
26-30 Jul 99	1999 Annual Navy Pollution Prevention Conference, Ritz Carlton, Pentagon City, VA	Kathi Jones	(805) 982-4899 e-mail: kjones@nfesc.navy.mil
27-28 Jul 99	Technology Symposium on Long-Lived Aircraft Primers, Air Force Research Laboratory, WPAFB, OH	Yvonne Watson	(702) 318-4668 e-mail: watsony@saic.com
10-12 Aug 99	13 th Weapon System Pollution Prevention Center Working Conference, Air Combat Command, Langley AFB, VA	Andy Dastous	(781) 337-4638 DSN 478-4638 e-mail: dastousa@hanscom.af.mil http://www.hanscom.af.mil/ESC-BP/pollprev/cwg.schd.htm
17-19 Aug 99	Summer PEWG Meeting, Pratt & Whitney, Montreal, Canada	Bob Bondaurek	e-mail: Bondaurek@itb-inc.com website registration: www.pewg.com
30 Nov - 2 Dec 99	SERDEP, Partners in Environmental Technology Technical Symposium and Workshop, Hyatt Regency Crystal City, Arlington, VA	SERDEP	http://www.serdep.org
6-9 Dec 99	4 th Annual Joint Services Pollution Prevention/Hazardous Waste Management Conference and Exhibition, Henry Gonzalez Convention Center, San Antonio, TX	Terra Thomas or Cathy Crane	(247) 259-2572 e-mail: tthomas@ndia.org

AIR FORCE MATERIEL COMMAND (AFMC) CENTER WORKING GROUP (CWG) CONFERENCE UPDATE

The 13th Weapon System Pollution Prevention Center Working Group (CWG) Conference is scheduled for 10- 12 August 1999 at Air Combat Command (ACC), Langley AFB, Virginia.

The presentations at the conference will focus on facilitating information exchange and cross-talk among the Air Force's Warfighters and those activities that support them. The presentations and discussions will allow participants to express their unique challenges when dealing with Warfighters and support activities. If you are interested in presenting your perspective at this meeting, please contact Mr. Andy Dastous (ESC/BP) by phone at (781) 377-4638/DSN 478-4638 or by e-mail: dastousa@hanscom.af.mil. Alternatively, please visit the AFMC CWG web site at <http://www.hanscom.af.mil/ESC-BP/pollprev/appcwg.htm> for further information. ♦